APPENDIX E
CHANGES IN MINERAL ACTIVITY

FUTURE MINERAL ACTIVITY

To help assess the reasonably foreseeable environmental impacts of the proposal and alternatives, the EIS team developed several assumptions on future mineral exploration and development under existing regulations, management practices, and policies (the No Action Alternative). These assumptions are fairly general, given the diversity of mining on public lands, variety of mining and exploration methods, commodities extracted, geographic scope, and inherent uncertainty of the commodities markets. These assumptions concerning the future under the No Action Alternative are made only for the purpose of EIS analysis, and to set the basis for comparison of the alternatives.

- Long-term commodity prices will remain relatively stable. Short-term price movement and volatility will continue for individual commodities. For example, the short-term prices for some metals will continue to be under pressure. But for the foreseeable future no obvious factors would suggest a trend of long-term increases or decreases in commodity prices, individually or collectively.

- Domestic exploration will remain relatively constant. Short-term increases and decreases in exploration, such as a recent decline, will continue in response to market and regulatory conditions. Exploration on public lands over the long term will also remain relatively constant.

- Long-term domestic production of minerals and the proportion coming from public lands will remain relatively stable. Short-term and commodity-specific changes will continue. Extended periods of lower or higher prices will affect short-term development and production decisions. Domestic gold production will likely remain flat or will slightly decline. Copper production will decline in the immediate future in response to market conditions but will likely recover in the longer term. Industrial mineral production will continue to increase, reflecting continued long-term growth in the domestic, regional, and most local economies.

- Existing mines will expand to take advantage of new technology and processing techniques, and will increasingly extract refractory-grade ores. These advances will be reflected in reduced capital and operating costs.

- The current geographic distribution of mineral activity will not change. For example, large open pit gold mining will remain concentrated in Nevada. Placer mining production will be concentrated in Alaska. Arizona will dominate large open pit copper mining. The mining of industrial minerals will remain more evenly distributed across the study area.

- Lands under federal ownership will remain the same for the foreseeable future.
- Public lands open to mineral entry under the mining laws will continue to decrease in the long

term as sensitive lands are set aside for environmental protection. The rate of this decline will vary in the short term, depending on the political and social climate. Although land availability is a critical factor in future mineral activity, mineral production on public lands has continued to increase since 1980 in spite of lands being withdrawn from mineral entry. This could also be due to the lag time between exploration and production, i.e. the high exploration rate in the 80s is responsible for the high production in the late 90s. The results of decreased land availability in the 90s and 2000s won't be felt until ~2005.

- Although a logical negative relationship exists between land withdrawals and future production, other factors such as emerging technology, global and domestic demands, and the large areas of public lands open to exploration and development have resulted in increasing production from public lands.

- Federal, state, and local environmental laws, regulations, policies, and restrictions will continue to become more protective over time. These limits to mineral exploration and development will affect federal, state, and private lands. In the face of increasing environmental restrictions, mineral production from public lands has increased since 1980. As with the discussion above of the effect of land withdrawals on future production, other factors (technology and demand) are likely to counterbalance the negative effect of increasing environmental restrictions on mineral activity.

- Overall, mineral activity on public lands will remain steady despite large drops in the past few years in the number of Notices and Plans of Operations reviewed by BLM. No overriding factors would suggest that a trend of increased or decreased activity has been established for either the short or long term. Activity will remain at current levels for the foreseeable future, including BLM's estimated review each year of 600 Notices and 150 Plans of Operations. The number of Notices and Plans of Operations filed and acres of disturbance expected under current management are discussed in the Mineral Resource Development section of Chapter 3.

CHANGES IN MINERAL ACTIVITY

Expected changes in mineral activity levels were estimated for each alternative. As with the assumptions for future mineral activity discussed above, it is neither practical nor even possible to develop complete information on future changes in mineral activity resulting from implementing the regulatory alternatives. The approach used to document the reasonably foreseeable significant effects conforms to the requirements at 40 CFR Part 1502.22 when dealing with situations where information is incomplete or unavailable. But this approach has substantial limitations. As such, the estimates are presented as reasonably foreseeable assumptions on future activity. The estimated changes in mineral activity are intended to help evaluate the environmental consequences of the proposed regulations and alternatives, and give the public and decision makers information on the potential direction and size of change. The assumptions are estimates of the expected changes in mineral activity and should not be considered accurate or precise estimates of change.

The changes in mineral activity were estimated based on interpretations by members of the EIS team using several information sources. These sources include impact matrixes and mine cost

models (discussed below) developed for this EIS, in addition to team member expertise, knowledge, and experiences. The EIS team members directly involved in making the estimates of change were Wendy Favinger, (Economist, BLM Montana State Office), Scott Haight (Mineral Specialist, BLM Lewistown Field Office, Montana), Paul McNutt (Economist, BLM Nevada State Office) and Dan Netcher (Geologist, BLM Ely Field Office, Nevada). The processes for interpreting these information sources were not standardized. Each team member independently interpreted the impact matrices and mine cost model results. We then compiled and discussed the estimates of change. This process involved several rounds of making, compiling, and discussing estimates of change. Through this iterative process, we reached a group estimate for each of the 10 types and sizes of mineral activity. Because of the uncertainties in forecasting and the many comments received on the estimates presented in the draft EIS, we opted to present the estimates of changes in mineral activity as ranges in the final EIS.

The process used by the EIS team to estimate changes in mineral activity and also to construct the impact matrixes is generally referred to as the Delphi Method. The Delphi Method is a decision making or forecasting process for addressing highly complex or ambiguous issues where factual data is absent. The process was originally developed by the Rand Corporation, a U.S. intelligence "think tank." The process is widely accepted and used to forecast events and outcomes.

Due to the limitations in data for mineral properties potentially affected by the proposed regulations and alternatives and the many potential affected properties, we deemed infeasible the applying of other analytic techniques to estimate changes in mineral activity. We selected the Delphi Method because of its past use in forecasting futures. We believed that this methodology was the most suitable approach for forecasting changes in mineral activity as a result of the implementing programmatic requirements.

Changes in mineral activity can be manifested in several ways, including changes in exploration and mining, acres disturbed, mine life, cutoff grade, and annual production. The response to changes in the regulations will be unique for each operation. As such, the following discussion is limited to change in overall activity without attempting to define how that change may be manifested.

Alternative 1–The No Action Alternative assumes that the current management and regulations continue unchanged. Thus the regulations are not expected to alter existing or future levels of mining. This does not necessarily mean that the level of future mining would not change. Many factors will affect the level of activity in both the short and long term. Commodity price, availability of lands for exploration and development, and environmental restrictions are key considerations that will affect future mineral activity. But no obvious or overriding factors would suggest that a trend of increases or decreases in activity for either the short or long term has been established. For this EIS, the overall future of mining under the Mining Law is assumed to remain relatively steady under existing regulations, management practices, and policies. It is from this baseline that the other alternatives are compared.

Alternative 2–The State Management Alternative would limit BLM's role in regulating activity under the Mining Law on public lands to that of a land owner. In most states this regulatory approach is expected to have the potential to reduce the regulatory burden to mining operations,

thus potentially increasing the level of mineral activity. Overall mineral activity on public lands is assumed to remain unchanged or increase by as much as 5% under Alternative 2. The greatest potential for increases in activity are expected in larger mining operations, specifically those now requiring EISs with extensive baseline studies. This regulatory burden would not decline and mineral activity increase uniformly in all states. For example, California and Montana have state versions of the National Environmental Policy Act. Proposed operations in those two states would not avoid the costs and time delays of preparing EISs. For a better understanding of the state regulatory programs in place, see Appendix D.

Alternative 3–For the proposed regulations, the estimate of change in mineral activity on public lands under the Mining Law will depend on the size and type of mineral operation (see Table E-1). The level of casual use is expected to remain relatively unaffected with the exception of some suction dredging. Exploration and mining now conducted under Notices and Plans of Operations are expected to decline by 5% to 30% from the baseline.

The financial guarantee and Notice/Plan threshold provisions in the proposed regulations would directly affect small mining operations that are now being conducted under Notices. Current Notice-level operations that would be required to submit Plans of Operations and follow the other provisions under this alternative would see direct costs increase by as much as 37%. Except for small open pit mines, Notice-level operations would decline in mineral activity by 10 to 20%. The estimated range of change in activity for open pit mines would be a 10 to 30% reduction.

For larger scale operations–those now required to submit Plans of Operations–the change in the definition of unnecessary or undue degradation in the proposed alternative to include "conditions, activities, or practices that result in substantial irreparable harm to significant scientific, cultural, or environmental resource values of the public lands that cannot be effectively mitigated" presents the greatest potential impact on the anticipated level of mineral activity on public lands. For large open pit mines the backfilling provision could also greatly increase operating costs and reduce activity. But because of the discretion given BLM in the proposed backfilling provision, changes in costs and activity levels are extremely difficult to estimate and would likely vary by mining project. For large open pit mines under the proposed regulations, the reduction in activity is estimated at 10 to 30%. This wide range in the estimated decline of open pit mining reflects the uncertainty inherent in how these two provisions in the proposal will be interpreted, implemented, and enforced.

Alternative 4–The alternative that is likely to most reduce overall mineral activity would also give the greatest level of environmental protection. Depending on the type of activity, Alternative 4 would reduce the individual mineral activity by 10% to 75%. Many of the provisions that would reduce activity levels, including the following:

- Eliminating the Notice provision.
- Requiring claim validity before mining.
- Mandatory penalties and enforcement.
- Automatic stays of all appealed decisions.

- Mandatory backfilling.
- Establishing specific unsuitability criteria and applying the new regulations to existing operations.

Alternative 5–The NRC Recommendations Alternative incorporates the numbered recommendations for regulation changes from the (NCR Report). The expected reduction in mineral activity under this alternative would mainly occur in small mining operations that are now Notice-level operations. The financial guarantee and Notice/Plan threshold provisions contained in this alternative will have a direct impact on small mining operations. For small placer, open pit, underground and industrial mines we estimate there will be a 5 to 10% reduction in mineral activity. For casual use, exploration and most large mining operations, mineral activity is assumed to remain unchanged or decrease up to 5% under Alternative 5.

Table E-1 gives a breakdown of the expected changes by type and size of mineral operation for each alternative except Alternative 1.

IMPACT MATRIXES

One analytic tool used to assess the potential effects of the are the impact matrixes that consider how each regulation provision would affect a particular mineral activity (See Tables E-2, thru E-5). The rating, weights and scores in these matrixes were developed using a qualitative process based on the expertise of EIS team members. The process is not intended to generate precise measurements of effect, but rather to show the direction and size of those potential changes and which regulatory provisions are likely to have the most effect.

The regulatory provisions were grouped into 28 regulation components (e.g. Notice-Plan Threshold, Appeals Process and Stay Provisions, Performance Standards: Pit Backfilling), and 10 mine types and sizes (e.g. small placer, large open pit). Specialists on the EIS team independently rated the effect each regulation component would have on the different types and sizes of mines, using the following scale: negligible or none = N, low positive or negative = L±, medium positive or negative = M±, and high positive or negative = H±. The team assigned a number values to each of the rating, N = 0, L =1, M = 3 and H =5. Each regulatory provision was weighted based on their relative importance to one another. The weighed values ranged between 1 to 5. The team then compiled and discussed the ratings. At several other rounds ratings were collected, compiled, and discussed. Through this iterative process a group rating was reached for each of the 28 regulation components. Tables E-2, E-3, E-4 and E-5 show the ratings for each of the provisions.

Table E-1. Percent Change in Mineral Activity

Alternative	Casual Use/ Suction Dredging	Exploration		Placer		Open Pit		Underground		Industrial Mine
		Small	Large	Small	Large	Small	Large	Small	Large	
2	0	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5	0 to +5
3	-5 to -10	-10 to -20	-10 to -20	-10 to -20	-5 to -15	-10 to -30	-10 to -30	-10 to -20	-5 to -15	-5 to -15
4	-40 to -50	-20 to -30	-20 to -30	-20 to -30	-15 to -25	-50 to -75	-50 to -75	-15 to -25	-10 to -20	-10 to -20
5	0	0 to -5	0 to -5	-5 to -10	0 to -5	-5 to -10	0 to -5	-5 to -10	0 to -5	-5 to -10

Note: The presented ranges reflect the uncertainties in estimating the impacts to mineral activity. Where there are greater uncertainty in assessing the potential impacts of an alternative on a particular size and/or type of mineral activity a larger range is presented.

Table E-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice vs. Plan of Operations Threshold	5	N	0	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5	L+	5
Definition of *Casual Use*	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	N	0	L+	3	M+	9	L+	3	M+	9	L+	3	M+	9	L+	3	L+	3	L+	3
State and Federal (BLM) Coordination	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Inspection and Monitor-ing Requirements	2	N	0	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2	L+	2
Penalties and Enforce-ment Procedures	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Financial Guarantee (Bonding) Requirements	4	N	0	N	0	L+	4	N	0	L+	4	N	0	L+	4	N	0	L+	4	L+	4
Modifications	2	N	0	N	0	N	0	L+	+2	N	0	L+	+2	N	0	L+	+2	N	0	L+	+2
Temporary or Permanent Closure	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Appeals Process and Stay Provisions	3	N	0	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	L+	3
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0

Table E-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Administrative Impact Subtotal			**0**		**16**		**29**		**18**		**29**		**18**		**29**		**18**		**23**		**25**
General Performance Stds/U or U Definition	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Land Use Plans	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Stability, grading, and erosion control	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	N	0	N	0	L+	3
Pit Reclamation	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Roads and Structures	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Surface and Ground Water Protection	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Topsoil or Growth Medium Handling	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3	N	0	L+	3
Revegetation	3	N	0	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3	L+	3

Table E-2. Alternative 2 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Fish and Wildlife Protection/Restoration	3	N	0	L+	3	L+	3	M+	9	M+	9	M+	9	M+	9	L+	3	M+	9	M+	9
Wetlands and Riparian Protection/Restoration	3	N	0	L+	3	L+	3	M+	9	M+	9	L+	3	M+	9	L+	3	M+	9	M+	9
Cultural, Paleo, Cave Resource Protection	3	N	0	M+	9	H+	15	M+	9	H+	15	M+	9	H+	15	M+	9	H+	15	H+	15
Performance Standards Impact Subtotal			**0**		**27**		**27**		**39**		**39**		**33**		**39**		**24**		**39**		**45**
Administrative and Performance Standard Impact Total			**0**		**43**		**56**		**57**		**68**		**51**		**68**		**42**		**62**		**70**

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2
Notice vs. Plan of Operations Threshold	5	L-	-5	M-	-15	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of *Casual Use*	1	M-	-3	L-	-1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	M-	-9	L-	-3	M-	-9	L-	-3	M-	-9
State and Federal (BLM) Coordination	3	L+	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	M-	-12	M-	-12	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	L-	-2
Inspection and Monitor-ing Requirements	2	N	0	N	0	N	0	L-	-2	L-	-2	L-	-2	N	0	L-	-2	N	0	N	0
Penalties and Enforce-ment Procedures	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Financial Guarantee (bonding) Requirements	4	N	0	M-	-12	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	L-	-4	M-	-12
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	N	0	L+	+3	L+	+3	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Administrative Impact Subtotal			**-13**		**-49**		**-23**		**-69**		**-34**		**-73**		**-34**		**-73**		**-26**		**-55**
General Performance Stds/U or U Definition	5	N	0	L-	-5	M-	-15	H-	-25	H-	-25	H-	-25	H-	-25	M-	-15	H-	-25	H-	-25
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	M-	-9	L-	-3	L-	-3	L-	-3
Stability, Grading, and Erosion Control	3	L-	-3	N	0	N	0	N	0	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Pit Reclamation	5	N	0	N	0	N	0	L-	-5	L-	-5	M-	-15	M-	-15	N	0	N	0	L-	-5
Roads and Structures	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Surface and Ground Water Protection	5	N	0	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5

Table E-3. Alternative 3 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	L-	-4	L-	-4	L-	-4	L-	-4	L-	-4
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Revegetation	3	N	0	M-	-9	L-	-3	M-	-9	N	0	N	0	N	0	N	0	N	0	N	0
Fish and Wildlife Protection/Restoration	3	N	0	L-	-3	N	0	M-	-9	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	L-	-3	N	0	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Performance Standards Impact Subtotal			**-9**		**-28**		**-29**		**-59**		**-47**		**-68**		**-74**		**-43**		**-47**		**-58**
Administrative and Performance Standard Impact Total			**-22**		**-77**		**-52**		**-128**		**-81**		**-141**		**-108**		**-116**		**-73**		**-113**

Table E-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where the Regulations Apply	2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2	L-	-2
Notice vs. Plan of Operations Threshold	5	H-	-25	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of *Casual Use*	1	H-	-5	M-	-3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	**3**	L-	-3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	L-	-3	M-	-9	L-	-3	L-	-3
State and Federal (BLM) Coordination	**3**	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	M-	-12	M-	-12	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20	H-	-20
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	M-	-6
Inspection and Monitoring Requirements	2	N	0	L-	-2	L-	-2	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6	M-	-6
Penalties and Enforce-ment Procedures	3	L-	-3	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9
Financial Guarantee (Bonding) Requirements	4	N	0	L-	-4	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	M-	-12	L-	-4
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2

Table E-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	L-	-3	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	L-	-3	M-	-9	H-	-15	M-	-9	H-	-15	H-	-15	H-	-15	H-	-15
Administrative Impact Subtotal			**-41**		**-79**		**-52**		**-113**		**-86**		**-119**		**-88**		**-125**		**-88**		**-99**
General Performance Stds/U or U Definition	5	N	0	L-	-5	L-	-5	H-	-25	M-	-15	H-	-25	M-	-15	H-	-25	M-	-15	H-	-25
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	M-	-9	M-	-9	H-	-15	M-	-9	M-	-9	H-	-15
Stability, Grading, and Erosion Control	3	L-	-3	N	0	N	0	N	0	N	0	H-	-15	H-	-15	H-	-15	H-	-15	H-	-15
Pit Reclamation	5	N	0	N	0	N	0	L-	-5	L-	-5	H-	-25	H-	-25	N	0	N	0	L-	-5
Roads and Structures	3	N	0	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	L-	-3	N	0	N	0	L-	-3
Leaching and Mineral Processing Operations	4	N	0	N	0	N	0	N	0	N	0	M-	-12	M-	-12	M-	-12	M-	-12	L-	-4
Surface and Ground Water Protection	5	N	0	M-	-15	M-	-15	L-	-5	L-	-5	H-	-25	H-	-25	H-	-25	H-	-25	M-	-15

Table E-4. Alternative 4 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Acid-Forming and Other Deleterious Materials	4	N	0	N	0	N	0	N	0	N	0	H-	-20	H-	-20	H-	-20	H-	-20	L-	-4
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	M-	-9	H-	-15	M-	-9	N	0	M-	-9
Revegetation	3	N	0	H-	-15	H-	-15	H-	-15	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9	M-	-9
Fish and Wildlife Protection/Restoration	3	N	0	M-	-9	M-	-9	H-	-15	M-	-9	M-	-9	M-	-9	L-	-3	L-	-3	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	M-	-9	M-	-9	M-	-9	L-	-3	M-	-9	M-	-9	L-	-3	L-	-3	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	M-	-9	M-	-9	L-	-3	M-	-9	L-	-3	M-	-9	L-	-3	L-	-3	M-	-9
Performance Standards Impact Subtotal			**-9**		**-74**		**-74**		**-89**		**-73**		**-179**		**-181**		**-133**		**-114**		**-119**
Administrative and Performance Standard Impact Total			**-50**		**-153**		**-126**		**-202**		**-159**		**-298**		**-269**		**-258**		**-202**		**-218**

Table E-5. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Definition of Federal Lands Where Regulations Apply	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice vs. Plan of Operations Threshold	5	N	0	L-	-5	N	0	H-	-25	N	0	H-	-25	N	0	H-	-25	N	0	M-	-15
Definition of *Casual Use*	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Notice and Plan of Operations Content and Processing Requirements	3	N	0	L-	-3	L-	-3	M-	-9	L-	-3	M-	-9	L-	-3	M-	-9	L-	-3	L-	-3
State and Federal (BLM) Coordination	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Claim Validity/Valid Existing Rights and Economic Viability	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Common Variety Materials Determinations	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Inspection and Monitor-ing Requirements	2	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Penalties and Enforcement Procedures	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Financial Guarantee (bonding) Requirements	4	N	0	M-	-12	L-	-4	H-	-20	L-	-4	H-	-20	M-	-12	H-	-20	L-	-4	M-	-12

Table E-5. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Modifications	2	N	0	L-	-2	L-	-2	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2	M-	-6	L-	-2
Temporary or Permanent Closure	2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2	N	0	L-	-2
Appeals Process and Stay Provisions	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Project Area Definition	1	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Applying Regulation Changes to Existing Operations	4	N	0	N	0	N	0	L-	-4	N	0	L-	-4	N	0	L-	-4	N	0	N	0
Administrative Impact Subtotal			**-3**		**-27**		**-12**		**-65**		**-16**		**-65**		**-24**		**-65**		**-16**		**-37**
General Performance Stds/U or U Definition	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Land Use Plans	3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3
Stability, Grading, and Erosion Control	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Pit Reclamation	5	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Roads and Structures	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Leaching and Processing Operations	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0

Table E-5. Alternative 5 Impact on Mineral Activity by Type and Size of Operation

		Casual Use/ Suction Dredging		Exploration				Placer Mining				Open Pit Metal Mine				Underground Metal Mine				Industrial Mineral Mine	
				Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		Small <5 acres		Large >5 acres		All Sizes	
Regulation Component	**Wt.**	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score	Impact	Score
Surface and Ground Water Protection	5	N	0	N	0	N	0	N	0	N	0	L-	-5	L-	-5	L-	-5	L-	-5	L-	-5
Acid-Forming and Other Deleterious Material	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Topsoil or Growth Medium Handling	4	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Revegetation	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Fish and Wildlife Protection/Restoration	3	N	0	L-	-3	N	0	M-	-9	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Wetlands and Riparian Protection/Restoration	3	L-	-3	N	0	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	L-	-3	N	0	L-	-3
Cultural, Paleo, Cave Resource Protection	3	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0	N	0
Performance Standards Impact Subtotal			**-6**		**-6**		**-6**		**-15**		**-9**		**-14**		**-14**		**-14**		**-8**		**-14**
Administrative and Performance Standard Impact Total			**-9**		**-33**		**-18**		**-80**		**-25**		**-79**		**-38**		**-79**		**-24**		**-51**

A similar process was used to obtain a weight for each of the regulation components. A weight (1 through 5) was intended to scale the relative importance of each of the regulation components. For example, the regulatory provision category covering *Pit Backfilling* was considered high in relative importance and was given a weight of 5. The *Stability, Grading, and Erosion Control* category, although important, was considered relatively less important and assigned a weight of 3. Definition of the *Project Area* was assigned a weight of 1, because it was considered one of the least important provisions relative to the other issues being considered in its potential to affect mineral activity. The weights can be found in the second column, following the description of the regulation component, in each of the impact matrixes.

The EIS team then used the ratings and weighs to estimate the expected effects of the 28 regulatory categories on each sector of the industry–the "score." To simplify the scoring, a numerical value category was assigned to a particular sector of the industry. Tables E-2, E-3, E-4 and E-5 show the scores for each of the regulatory provision categories.

Table E-6 summarizes the scores for all alternatives, broken down by the effects of administrative requirements and effects attributable to the environmental performance standards. To help put these scores in context, the greatest possible score for each alternative is ±440.

Alternative 2–Using this methodology, the EIS team gave Alternative 2 a relatively small positive score for both the administrative and performance standard requirements for all categories of commercial mineral activity. None of the provisions of Alternative 2 were expected to affect casual use.

Several provisions of Alternative 2 were projected to benefit mining on public lands (Table E-2). Provisions with the highest positive scores include Notice and Plan of Operations content and processing requirements; fish and wildlife protection and restoration; wetland and riparian protection and restoration; and cultural, paleontological, and cave resource protection. These positive effects on mining mainly relate to reductions in the following: time delays for reviews and approvals, costs of content and analysis requirements, habitat restoration costs, and costs of documenting and salvaging cultural and paleontological resources.

Because Alternative 2 would rely on the state programs to regulate mining on public lands, this positive effect would not be uniform across all states. For example, California and Montana have state National Environmental Policy Act (NEPA) laws requiring comprehensive environmental review and public participation in the decisionmaking process similar to that now required on public lands under NEPA. For these two states Notice and Plan content and processing requirements would likely have minimal benefits.

Alternative 3–For most types and sizes of mining activities the proposed regulations received a relatively large negative score (Table E-3). The exception is casual use, which will be relatively unaffected by the provisions in Alternative 3.

Table E-6. Impact Score Summary on Mineral Activity by Type and Size of Operation

Alternative	Casual Use/ Suction Dredging	Exploration		Placer Mining		Open Pit Metal Mine		Underground Metal Mine		Indus-trial Mineral Mine
		Small <5 ac.	Large >5 ac.	Small< 5 ac.	Large >5 ac.	Small <5 ac.	Large >5 ac.	Small <5 ac.	Large >5 ac.	All Sizes
Alternative 1 - No Action (Existing Regulations)										
Admin. Impact Subtotal	0	0	0	0	0	0	0	0	0	0
Perf. Std. Impact Subtotal	0	0	0	0	0	0	0	0	0	0
Alternative 1 - Total	0	0	0	0	0	0	0	0	0	0
Alternative 2 - State Management										
Admin. Impact Subtotal	0	16	29	18	29	18	29	18	23	25
Perf. Std. Impact Subtotal	0	27	27	39	39	33	39	24	39	45
Alternative 2 - Total	0	43	56	57	68	51	68	42	62	70
Alternative 3 - Proposed Regulations (Proposed Action and Preferred Alternative)										
Admin. Impact Subtotal	-13	-49	-23	-69	-34	-73	-34	-73	-26	-55
Perf. Std. Impact Subtotal	-9	-28	-29	-59	-47	-68	-74	-43	-47	-58
Alternative 3 - Total	-22	-77	-52	-128	-81	-141	-108	-116	-73	-113

Table E-6. Impact Score Summary on Mineral Activity by Type and Size of Operation (continued)										
Alternative 4 - Maximum Protection										
Admin. Impact Subtotal	-41	-79	-52	-113	-86	-119	-88	-125	-88	-99
Perf. Std. Impact Subtotal	-9	-74	-74	-89	-73	-179	-181	-133	-114	-119
Alternative 4 - Total	-50	-153	-126	-202	-159	-298	-269	-258	-202	-218
Alternative 5 - NRC Recommendations										
Admin. Impact Subtotal	-3	-27	-12	-65	-16	-65	-24	-65	-16	-37
Perf. Std. Impact Subtotal	-6	-6	-6	-15	-9	-14	-14	-14	-8	-14
Alternative 5 - Total	-9	-33	-18	-80	-25	-79	-38	-79	-24	-51

Small mining operations, specifically those that are now Notice-level operations, will face several new requirements, including the Notice/Plan threshold and financial guarantee provisions. These requirements will result in costly changes to most small mining operations. All exploration and mining will potentially be affected by the new definition of unnecessary or undue degradation. As a management tool the effect on mining would logically be felt by both large and small operations. As a basis for challenging BLM decisions, large mines that are subject to public scrutiny would likely be the most affected. The extent of the effect on mineral activity is speculative and will likely not be known for many years. This unknown aspect of the provision will contribute to the uncertainties of and have a negative effect on mineral activity.

The pit backfilling provision in the proposed regulations is the environmental performance standard most likely to harm mining operations. The use of the non mitigateable significant irreparable harm standard in the undue and unnecessary definition will also potentially harm the mining operations. Because implementing these provisions would depend on site-specific conditions and the discretion allowed BLM, it is difficult to even qualify the size of the effect across the industry. Clearly, these provision have the potential to greatly affect individual open pit mines.

Alternative 4–Alternative 4 would impose the greatest administrative burden and generally has the highest environmental performance standards of all alternatives considered in this EIS (Table E-4). For most mining and exploration on the public lands Alternative 4 would have a higher adverse effect than the other alternatives. For casual use this alternative received a relatively small negative score.

Both administrative and performance standards under Alternative 4 would have a relatively high adverse effect. The administrative requirements with the greatest negative effect on mining under Alternative 4 include the Notice/Plan threshold, financial guarantees, claim validity, appeals process, and applying the new regulations to existing operations. The change to the Notice/Plan threshold would affect only operations that would be Notice-level operations under the existing regulations. The other provisions would harm operations regardless of size. Most all of the environmental performance standards would have a moderate to high adverse effect on some segment of the industry. Mandatory pit backfilling, for example, would have an extremely high negative effect on open pit mining. At the same time the backfilling provision would at most only slightly affect some other forms of mineral activity.

Alternative 5–Small mining operations, specifically those that are now Notice-level operations, will be subject to new Notice/Plan threshold and financial guarantee requirements under this alternative. These two requirements will result in costly changes to most small mining operations. Mines that are not affected by these two provisions will go relatively unaffected by this alternative. Notice-level exploration will be subject to the financial guarantee requirement but not the requirement to prepare a Plan of Operations. As such, small exploration received a relatively small negative score.

MINE COST MODELS

Regulation changes generally affect the mining industry economically. Effects involve such environ-mental costs as permitting and reclamation, and the time value of money. To determine how these regulatory alternatives will affect operators and the mining industry, mine cost models were developed to estimate general costs of mining for analysis purposes. These models are theoretical and highly general. They do not represent any existing operations. Using the mineral activities and various types of mining methods on public lands, one cannot reasonably model all the scenarios. The models presented here are an attempt to represent the basic range of activities from casual use to major mining projects in relation to the 43 CFR 3809 regulations. The models are for analysis purposes only to show the general economic impact of the regulation alternatives. The models are for the following types of operations:

- Casual use.
- A small exploration operation of less than 2.5 acres.
- An exploration project up to 5 acres.
- A small placer operation of 2.5 acres.
- A larger placer operation exceeding 5 acres.
- A small mining operation under 5 acres.
- A larger mining operation exceeding 5 acres.

The following data and assumptions are used to develop these models.

1. The operating and capital costs were developed from reference models presented in *Mining Cost Services* (Western Mine Engineering, Inc. 1997), section CM, Cost Models.

A. The following items are included in operating and capital costs:
- All labor, material, supply, and equipment operation costs incurred at the mine or mill site, including supervision, administration, and onsite management.
- Benefits and employment taxes.
- All onsite development.
- Mine and mill equipment and facilities, purchases, and installation or construction.
- Limited haul road construction.
- Engineering and construction management fees.
- Working capital.
- Tailings disposal.

B. The following items are not included in operating and capital costs:
- Exploration.
- Permitting and environmental analysis costs.
- Contingencies.
- Access roads, power lines, pipelines, or railroads to the mine and mill site.
- Home office overhead.
- Taxes (except sales taxes).
- Insurance.

- Depreciation.
- Townsite construction or operation.
- Offsite transportation of products.
- Incentive bonus premiums.
- Overtime labor costs
- Sales expenses.
- Smelting and refining costs (except ore production at hydro metallurgical mills).
- Interest expenses.
- Startup costs (except working capital).

2. Permitting, environmental, and reclamation costs are estimated from BLM experience in Nevada, Alaska, and Montana.

3. The equipment used to develop and extract ore from the mine will also be used in reclamation.

4. The costs described in these models will be generally borne by the industry and not BLM. On the basis of site-specific factors and implementation decisions, some of these costs may be borne by BLM or the operator. Operations that are not complex and do not require costly information to process the environmental documentation and reviews may not result in cost increases to the operator. These operations usually are small exploration projects, small placer operations, and non-complex mines. Costs are estimated for analysis purposes in these models.

5. Placer model costs are derived from Montana Placer Mining BMPs (best management practices) SP 106 and Environmental Protection Agency, Economic Impact Analysis of Final Effluent Limitations Guidelines and Standards for the Gold Placer Mining Industry.

6. Time delays are not addressed as costs in the mine cost models. The effect of time delays are addressed in the discount cash flow analysis presented in the following section. It is assumed that operators will submit complete documents in a timely manner and that BLM will process projects in a timely manner. This is not always the case. We recognize the importance of uncertainties, delays, and lengthy permitting processes as negative factors affecting the economics of mineral exploration and development. These factors can become so onerous that individual projects may be abandoned. The models address known permitting time increases from the regulation provisions, but most aspects of cost of delays are project specific and not conducive to programmatic analysis.

7. Operators will comply with the regulations.

8. Acres disturbed are averages based on actual mine plans and notices submitted to BLM.

9. Costs for equipment were derived from *Rental Rate Blue Book* by K-III, *Mine and Mill Equipment Cost* by Western Mine Engineering, Inc. (1997a) and from bond calculations accepted by BLM.

10. Labor costs were derived from *Mining Cost Service* by Western Mine Engineering, Inc. (1997b), Davis and Bacon Wage Grade tables, and bond calculations accepted by BLM.

11. This analysis assumes that these costs will not be affected by regulation changes. Regulation changes for this analysis will affect permit authorizations and reclamation and closure aspects of mining.

12. Reclamation costs for this analysis include chemical stabilization, removal of equipment and structures, earth work, erosion and water controls, and revegetation.

13. Permit and environmental costs are averages obtained from the mining industry, environmental consultants, and BLM offices. These costs include all costs of preparing environmental documents under the National Environmental Policy Act, cultural work under the Archaeological Resources Protection Act, and other legal requirements to permit operations under existing regulations. Each type of document could have a wide range of cost based on the complexity of the issues being addressed on the site. For example, during the survey for this document showed that the cost of an EA can range from $0 to $200,000 and of an EIS from $50,000 to $2,200,000. For this model exercise it was determined that only one price for each type of document would be used to show an incremental cost of these regulations. But it will be noted in some models where BLM thinks costs would be lower on the basis of the type of project and model.

14. Financial guarantee costs are based on current BLM practice. No bonding is required for Notice-level operations. Exploration Plans of Operations are bonded at cost or $1,000/acre, whichever is lower. Mining Plans of Operations are bonded at 100% of the cost for closing and reclaiming mines that used chemical processing or have ARD potential. Other mining areas are bonded at the ~~and~~ cost of reclamation or $2,000/acre, whichever is lower.

15. Stream restoration costs were derived from the *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991), prepared for the U.S. Environmental Protection Agency. The "stream and floodplain reconstruction" was used as the cost figures in these models.

16. The amount of material (topsoil, waste rock) has been estimated for analysis purposes. The estimates will be used from model to model to show estimated changes in cost.

17. The mine models do not spread costs through the years of the project but assume that the capital costs will be accrued in years 1 and 2, operating costs over the life of the project, reclamation costs in the last 2 years of the project, and environmental and permitting costs in the first year.

18. The cost of a validity exam is used for the cost of conducting a feasibility study under Alternative 4.

19. The following cost calculations assume that the state program is similar to the State of Nevada program. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements. States appear generally not to review operations smaller than 5 acres but to require reclamation.

As discussed above, the main areas of impacts to the industry are in reclamation and permit/ environmental compliance. To better understand these relationships, the following theoretical costs have been derived for the models above. These costs were used as a basis for estimating economic changes in mining.

Casual Use Operations

The term of casual use is defined as mineral activities that only negligibly disturb federal lands and resources. Casual use does not include the use of mechanical earth-moving equipment or explosives or the use of motorized equipment in areas closed to off-road vehicles.

In general, casual use includes most of the initial exploration activities of prospectors and independent geologists. As described in Chapter 3, Development of Mineral Properties, the development of a mine from grassroots explorations to production is done is several phases. The beginning operations include reconnaissance work, small exploration and prospecting. On the ground work for exploration include grab samples, geophysical exploration, stacking claims, soil samples taken with hand augers, and geochemical samples. On-the-ground prospecting includes pick and shovel work on claims, panning and rocker box type exploration, and rock collecting. All of these activities are included in casual use operations.

Alternative Analysis

Alternatives 2, 3, and 5 would not change the ability of the independent geologist and prospector to engage in casual use. There will be no cost to the companies from the requirements in these alternatives. These three alternatives would not restrict the operator from conducting early reconnaissance, exploration, and prospecting. Alternative 4 does not change the definition of casual use but does require the operator to consult with the BLM on all activities other than claim staking. This consultation will determine if the activity is casual use or if a Plan of Operations is required. For this analysis we assume the ability of the independent geologist and prospector to use casual use under Alternative 4.

Small Exploration Project

The small exploration project is the next type of operation that develops and delineates the potential mineral deposit. The operator is usually a independent geologist or small mining/exploration company that explores for undiscovered deposits and sells interests in these deposits to major mining companies.

In developing the property, the prospector or independent geologist may be developing the information and property in hopes or selling them to a major company. Because these entities hope to realize their profit with the sale of the property and information, they do not pay themselves wages for their work. Under this scenario the cost of the operation would be decreased by the wage of the project geologist.

Project size:	1 to 2 acres
Project life:	Less than 1 month
Proposed evaluation methods:	Drill holes (10), for this model an average of 200 feet deep
Equipment:	Truck mounted, self-contained drill
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note: this operation could require a Plan of Operations if located on special category lands.
Reclamation:	Recontouring and revegetation, stream restoration, immediately after drill hole evaluation.

Permitting Cost: Under this operation the independent geologist will submit the Notice to BLM. The Notice usually is hand written, includes a map, and would take 4 hours to compile and provide to BLM. The estimated cost would be $200. But the document could vary in size and technical sophistication. Permitting and environmental costs can be difficult to estimate because they can vary greatly by site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

Operation Cost: The operation would include one track-mounted drill rig with driller and helper. The project geologist would also be present at the site and would require two 4X4 pickups to transport workers to and from the site. There would be a mobilization and demobilization cost to haul equipment to and from the site. The driller would be able to drill one of more holes per day and complete reclamation by filling the drill holes and spreading the drill cuttings out. The project would be completed in one work cycle of 10 days at 10 hours per day.

This model assumes no capital expenditure for this operation. The company or individuals would pay rental or operational costs. For this operation, it is assumed that the truck is owned by the project geologist and the drilling rig is rented or leased.

Capital Cost		$0.00
Operating Costs		
Track Drill Rig	$4825.00/week for two weeks	$9,650
4X4 pick up	$160.00/week for two weeks	$320
Mobilization and Demob	$500.00/vehicle	$500
	Total	$10,470

Labor

Driller	$40.00/hr for 10hrs/day at 10 days	$4,000
Laborer	$28.00/hr for 10hrs/day at 10 days	$2,800
	Total	$6,800

Reclamation Cost: The main reclamation would be plugging the drill holes and cleaning up the drill cuttings. For the purpose of this model the 10 holes are dry and require only backfilling. The

operator will take a half hour to plug the hold and spread out the drill cuttings, and this would be completed during the drilling operations. The project geologist would be required to visit the site once to get environmental compliance, and this visit would require a full day at $25/hr for 10 hours for an added reclamation cost of $250.

This model assumes that the exploration holes were drilled either on existing roads and trails or cross county with no road building. Therefore, no more reclamation would be required.

Table E-7. Exploration Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting (Notice Preparation)	Project Geologist	$200	$200
Exploration Activity:			
Operating Cost - Labor			$6,800
Operating Cost - Equipment			$10,470
Exploration Activity Total			$17,270
Reclamation:			
Site visit	Project Geologist	$25.00/hr	$250
Total Cost of Exploration Project			$17,670

Alternative 1: Current Management

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: The following cost calculations assume that the state program is closely based on current State of Nevada regulations, with a few differences. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements. States appear generally not to review operations smaller than 5 acres but to require reclamation.

This analysis assumes that the state will not require that any information be submitted because the project occupies less than 5 acres. The state will still require reclamation and will monitor the activity area for compliance.

Permitting and Environmental Costs: The operator would not have to submit a Notice to BLM and usually would not have to submit anything to the state. The operator would therefore save the direct cost of document preparation. An operator making project changes would save

time by not having to contact BLM. By not having to prepare a Notice, the operator would save about $200.

Reclamation Costs: This analysis assumes that the state requires reclamation. The reclamation would be complete at the end of the operation and would not need a compliance inspection.

Total Estimated Cost Changes: Total cost savings for this exploration project under Alternative 2 are summarized in Table E-8.

Table E-8. Alternative 2: Changes in Costs for Small Exploration Project	
Total Project Cost under Alternative 1 (Existing regulations)	$17,670
Change in Costs under Alternative 2 due to Elimination of Notice Preparation No Compliance Inspection Total Change in Costs under Alternative 2	 (200) (250) (450)
Total Project Cost under Alternative 2 (State Management)	$19,870
Percent Change in Costs from Alternative 1 to Alternative 2	- 2 %

Alternative 3: Proposed Action

General: Alternative 3 would establish outcome-based performance standards. This approach outlines to the industry what standards must be met on public lands but lets operators determine how to meet these standards. Impacts to exploration would be slight because BLM and industry are already generally following these procedures in authorizing operations and accepting reclamation. The operation would be bonded for reclamation, and the operator could incur costs for noncompliance and could pay penalties.

Depending on the location of the operation, the operator could be required to submit a Plan of Operations. Where a Notice-level operation would be required to submit a Plan of Operations represents the greatest potential cost increase under Alternative 3. In addition, for withdrawn lands a validity exam would be required and may involve costs to the operator. We assume these types of actions would not occur often.

Permitting and Environmental Costs: The costs that could be incurred under the Proposed Action would be the cost of bonding a Notice and the costs resulting from operations being in areas classified as sensitive and required to submit Plans of Operations.

Processing Content - Alternative 3 generally would allow the operation to remain a Notice. The cost of preparing the Notice would not change. If a Plan of Operations is required, the project would be delayed. This model assumes that more information would be required. The project geologist would take an estimated 2 days to prepare the maps and get the information needed for the Plan of Operations, $1,000 in labor and materials.

Bonding - Bonding would be required at 100% of the reclamation cost to be performed by a third party (not the operator). One laborer would have to drive to the location and fill the drill holes and rake out the drill cuttings, and a $500 cash bond would have to be submitted to BLM.

Notice Versus Plan Threshold - Under the Proposed Action, requirements for filing Plans of Operations or Notices would be expanded. More categories of exploration would need Plans of Operations. If the exploration project goes to a Plan, the company would experience extensive time delay and costs. The cost of the environmental assessment by a third-party contractor would range from $10,000 to $100,000, depending on the complexity of the operation. For this type of project, it is assumed the document cost is $10,000.

Normally, on an operation of this size BLM would complete the NEPA document. But this model assumes that the operator will bear the cost of preparing the document, $10,000. The document would be completed within the 30 days time frame.

Validity Exams - This provision requires that BLM conduct a validity exam before approving a Plan of Operations within an area withdrawn from the mining laws. These operations are statistically few but do exist on the public lands. The major concern and cost to the operator is the delay of processing the exam. The companies would not usually pay for the mineral exam but must support the mineral examiner in preparing the report. The average cost to BLM of

conducting a validity exam is about $10,000. For this analysis we assume that BLM would recover the cost of the validity exam from the operator. Few operations would be subject to validity exams; 2% of mining activities are assumed to require this additional cost.

Reclamation Costs: No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is in an area that has not been withdrawn from the mining laws and does not require a Plan of Operations, the exploration company would bear no additional cost under the Proposed Action beyond the cost of bonding. But if the project needs to submit a Plan of Operations or the area of exploration has been withdrawn from mineral entry, the operator would have to pay for a third-party environmental assessment (EA), and a validity exam would be required before operations could begin. Estimated cost changes are summarized in the Table E-9.

Table E-9. Alternative 3: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$17,670
Change in Costs under Alternative 3 due to	
Bonding	$500
Total Change in Costs under Alternative 3	$500
Total Project Costs under Alternative 3	20,820
Percent Change in Costs from Alternative 1 to Alternative 3	2%
Change in Costs Assuming Plan of Operations Required and Validity Exam is Conducted	
Change in Costs under Alternative 3 due to	
Bonding	500
Plan Preparation	1,000
Environmental Assessment	10,000
Validity Exam	10,000
Total Change in Costs under Alternative 3	21,500
Total Project Costs under Alternative 3	$41,820
Percent Change in Costs from Alternative 1 to Alternative 3	106%

Alternative 4: Maximum Protection

General: Alternative 4 is based on design standards that establish specific criteria for protecting environmental resources. These types of standards and criteria would affect exploration operations. The elimination of Notices would directly affect an exploration project in bonding, inspection, and enforcement; soil stability; topsoil; drill hole plugging; and revegetation. The need for a validity exam, bonding criteria, fish and wildlife habitat, and wetlands would affect exploration.

This model assumes that the operator would comply with the regulations and therefore pay no

penalties. The automatic stay for appeals under Alternative 4 could delay exploration as well as potential future profits if an economic deposit is discovered. The cost to the operator of the delays are addressed in the discount cash flow analysis in the next section.

Permitting and Environmental Costs: The standards for road construction were developed for well-maintained roads and not for exploration roads. It is assumed that road building will be based on site conditions.

Bonding - Bonding would be as outlined for Alternative 3 but would include more costs for unplanned events (spills, releases, and cleanup). For exploration projects added costs for major environmental problems would probably not need to be addressed except for potential petroleum spills. Any petroleum spill would require removing contaminated soils and trucking them to an approved disposal site for treatment. The potential cost would be added to the bond amount. The exploration model assumes that the operator would place the full amount of the bond into a certified deposit. The operator would again get a bond through a bonding company. The total estimated bond amount would be $1,500, and the estimated cost of reclamation would amount to $500 for general reclamation as described for Alternative 3, plus $1,000 more for a potential unplanned petroleum spill.

Notice Versus Plan Threshold - Under Alternative 4, Notice-level operations and all other mineral activity, including exploration, would be replaced by Plans of Operations. The cost of developing and reviewing Plans would apply as outlined for Alternative 3. Estimated costs for an exploration project to file a Plan of Operations would total about $11,000 ($1,000 for preparing a Plan of Operations and $10,000 for preparing an environmental assessment of small complexity, with costs borne by the operator).

Inspections - Under Alternative 4, operators would be required to hire third-party contractors to monitor their operations. This project would require three inspections: once during exploration, once during reclamation, and once for final reclamation and clearance. The monitoring would not require an overnight stay, but 10 hours would be needed to get to the site, complete the inspection, and return to the office and complete the report. No samples would be needed for this program. Total estimated costs for inspection would amount to $1,500 (assuming one inspector, three trips, 10 hours/trip, at $50/hr).

Validity Exams - This provision requires that a validity exam be conducted before a Plan of Operations is approved. This cost would remain the same as outlined for Alternative 3. The average cost to BLM of conducting a validity exam is $10,000. BLM would recover the cost of the validity exam from the operator.

Reclamation Costs: Reclamation for wetlands and fish and wildlife habitat would remain the same for this model as under Alternative 1, No Action. The assumption is that the mining industry overall would be diligent and disturbances would be reclaimed within the 10-year limit. Therefore, no other habitat restoration would be required, and no more costs are assumed.

This is a short-term exploration project, and soil stability design limits would not be approached

because of reclamation. Any steep slopes could have some erosion control problems, but no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Water Resources - For the exploration model 50 drill holes would be drilled with a diameter of 5.5 inches. This holes are assumed to be dry. Under Alternative 4 the holes would be plugged with bentonite and 10 feet of cement. Total estimated cement capping costs would amount to $1,250 (assuming 50 holes, 10 feet/hole, at $2.50/linear foot). Total estimated plugging costs would amount to $16,150 (assuming 190 feet/hole, at $1.70/linear foot).

Revegetation - No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn for minerals, the project would incur the costs shown in Table E-10.

Table E-10. Alternative 4: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1:	$17,670
Change in Costs under Alternative 4 due to:	
Bonding	1,500
Plan Preparation	1,000
Environmental Assessment	10,000
Third-Party Monitoring	1,500
Drill hole Plugging	17,400
Validity Exam	10,000
Total Change in Costs under Alternative 4:	$41,400
Total Project Costs under Alternative 4:	$61,720
Percent Change in Costs from Alternative 1 to Alternative 4:	203%

Alternative 5: NRC Recommendations

General: A small exploration project would continue to be allowed as a Notice-level activity. The costs that could be incurred under Alternative 5 would be the cost of bonding a Notice. Therefore, the operator would be required to post a cash bond of $500.

Table E-11. Alternative 5: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$17,670
Change in Costs under Alternative 3 due to Bonding	$500
Total Change in Costs under Alternative 3	$500
Total Project Costs under Alternative 3	20,820
Percent Change in Costs from Alternative 1 to Alternative 3	2%

Exploration Model

This operation is run by a medium-sized exploration company that owns its equipment or rents all of its equipment. This operation will have no major capital costs. The model assumes the exploration is for precious or base metals.

Project size:	4 acres disturbed
Project life:	Less than 6 months
Proposed evaluation methods:	Drilling (50 holes) and trenches (5) @ 100'x5'x0'
Equipment:	Truck-mounted self-contained drills, tracked excavator (Cat 231D), dozer (Cat D7H)
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note: This operation could require a Plan of Operations depending on alternative or whether the operation is located on sensitive lands.
Reclamation:	Recontouring and revegetation, stream restoration, immediately after completion of drill hole/trenching evaluation.

Permitting and Environmental Costs: Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorizations and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the costs can cover a broad range. For the following costs, several mining companies and consultant firms were contacted, and average costs were derived. These costs are described below and are detailed in Table E-12.

This exploration operation would file a Notice, and no bond or environmental documents would be required. All actions would be handled by the local BLM office with which the Notice is filed. The only cost to the operator would be to prepare the document to be submitted to BLM. Two people would need 3 days with AutoCAD support to complete the documentation for the Notice, at a cost of $1,000.

Reclamation Costs: Earthwork would include ripping all roads and drill pads, recontouring roads and pads, and plugging drill holes. The work would take 20 hours to complete. Each piece of equipment would operate for 10 hours. The 50 dry drill holes, 200 feet deep, would be backfilled with drill cuttings. This work would take one operator an extra half hour to complete. Equipment needs include a bulldozer and a tracked excavator at a cost of $2,200. Labor costs are estimated to total $1,600 for two equipment operators. Drill hole plugging is estimated to result in added labor costs of $100. For revegetation, no ground preparation is needed for seeding. The model assumes that the project is completed during good seeding times of the year. The seed mixture would be a combination of native and exotic plants as outlined in the open pit model. The priority is to stabilize the soil. An estimated 4 hours would be needed for seeding. Because of the nature of this operation, chemical stabilization and removal of structures would not be needed.

Table E-12. Exploration Model Costs			
Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting (Notice Preparation)	2 people, 3 days each	$500 ea	$1,000
Exploration Activity:			
Operating Cost - Labor			50,000
Operating Cost - Equipment			150,000
Exploration Activity Total			200,000
Reclamation:			
Earthwork			
Equipment	1 dozer (Cat D7H) - 10 hrs	120/hr	1,200
	1 tracked excavator (Cat 231D) -10	100/hr	1,000
Labor	hrs	40/hr each	1,600
Drill holes (50)	2 equipment operators, 20 hrs each	40/hr	100
Revegetation	1 operator, 2.5 hrs		
Seed Mixture		56/ac	225
Labor	4 acres	28/hr	112
Miscellaneous	1 laborer, 4 hrs		
Mob/Demob		500/vehicle	1,000
Supervision	2 vehicles		
Equipment		40/day	40
Labor	½ ton 4X4 pickup, 1 day	25/hr	160
Reclamation Total	environmental manager, 8 hours		5,437
Total Cost of Exploration Project			$207,337

Miscellaneous Costs: The equipment to complete reclamation is assumed not to be located at the site. Therefore, mobilizing and demobilizing the equipment would involve more costs to industry. The operation usually would require 8 hours of supervision (employed by the company) to ensure that reclamation is completed correctly.

Alternative 1: Current Management

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2 - State Management

Estimating costs for this alternative for each of the 12 states in the study area would be impractical for this exercise. Therefore, the following cost calculations assume that the state program is closely based on current State of Nevada regulations with a few differences. A review of state programs found that most states appear to be similar in posting bonds for reclamation and in reclamation and surface and ground water requirements. States appear generally not to review operations smaller than 5 acres but to require reclamation.
This analysis assumes that the state will not require any information to be submitted because the project occupies less than 5 acres. The state will still require reclamation and monitor the activity

area for compliance.

Permitting and Environmental Costs: The operator would not have to submit a Notice to BLM and usually would not have to submit anything to the state. The operator would therefore save the direct cost of document preparation. An operator making project changes would save time by not having to contact BLM. By not having to prepare a Notice, the operator would save about $1,000 (assuming Notice preparation would take two people 3 days to complete).

Reclamation Costs: This analysis assumes that the state requires reclamation. The company would have to reclaim any disturbance from its operation. The analysis also assumes that reclamation would not require restoring wildlife and fisheries habitat. For exploration operations this restoration could be represented by the types of seed mixtures used. The analysis assumes that the state will require only grasses to stabilize soils. Using the seed mixture in the open pit model and using only the grasses in the mixture would bring the cost to only $28/acre instead of $56/acre. A total of $112 would be saved on revegetation costs (assuming per-acre savings of $28 for the seed mixture).

Total Estimated Cost Changes: Total cost savings for this exploration project under Alternative 2 are summarized in Table E-13.

Table E-13. Alternative 2: Changes in Costs for Small Exploration Project

Total Project Cost under Alternative 1 (Existing regulations)	$207,337
Change in Costs under Alternative 2 due to	
Elimination of Notice preparation	(1,000)
Change in Seed Mixture	(112)
Total Change in Costs under Alternative 2	(1,112)
Total Project Cost under Alternative 2 (State Management)	$206,225
Percent Change in Costs from Alternative 1 to Alternative 2	- 1%

Alternative 3: Proposed Action

General: Alternative 3 would establish outcome-based performance standards. This approach outlines to the industry what standards must be met on public lands but lets mine operators determine how to meet these standards. Impacts to exploration would be slight because BLM and industry are already generally following these procedures in authorizing operations and accepting reclamation. Industry will have no costs for paying penalties.

Any operation within a mineral withdrawal area would have the extra cost of time and money for completing a validity exam of mining claims. These types of actions would not occur often and are assumed for this model to be addressed as no cost.

Under the Proposed Action, the most significant potential change would be the possibility that this Notice-level operation would now be required to submit a Plan of Operations.

Permitting and Environmental Costs: The greater cost under the Proposed Action would mainly be the cost of bonding a Notice. Other costs could result from operations in areas now being classified as sensitive.

Bonding - Bonding would be strengthened to include bonding of Notices at 100% of the reclamation cost. Plans of Operations would be bonded at 100% of the reclamation cost. Bonding would be used to pay for site reclamation if operators cannot fulfill their reclamation obligations. This model assumes that the operator is obtaining the bond from a bonding agency and would pay only a certain percentage for the bond amount. The total amount of the bond is estimated to be $272, or 5% of reclamation costs ($5,437 @ 5% = $272/year).

Notice Versus Plan Threshold - Under the Proposed Action, requirements for filing Plans of Operations or Notices would be strengthened. More categories of exploration would need Plans of Operations than before.

Estimated costs for an exploration project that would be required to file a Plan of Operations would total about $82,500 ($2,500 for preparing a Plan of Operations and $80,000 for preparing an environmental assessment of moderate complexity, with costs borne by the operator).

Processing Content - Alternative 3 could delay and increase costs for exploration projects having short turnaround times. The model assumes that the Proposed Action would result in no costs of delay if industry plans reasonably well and BLM's processing of the Notice is timely. Time delays of from 15 to 30 days for approval should not increase costs. But problems could result if delays are not scheduled and the operation assumes the cost of standby time for drill rigs and workers. BLM's late processing of permits could add to this cost. No delays are assumed for this model.

Validity Exams - This provision requires that BLM conduct a validity exam before approving a Plan of Operations within an area withdrawn from the mining laws. These operations are statistically few but exist on the public lands. The major concern for industry is the delay of processing the exam. The companies would not usually pay for the mineral exam but must support the mineral examiner in preparing the report. The average cost to BLM of conducting a validity exam is about $10,000. BLM would recover the cost of the validity exam from the operator. Few operations would be subject to validity exams; only 2% of mining activities are assumed to require this additional cost.

Reclamation Costs: No additional reclamation costs would be required under Alternative 3.

Total Estimated Cost Changes: If the exploration operation is in an area that has not been withdrawn from the mining laws and does not require a Plan of Operations, the exploration company would bear no additional cost with proper coordination. But if the project needs to submit a Plan of Operations and the area of exploration has been withdrawn from mineral entry, the operator would have to pay for a third-party environmental assessment (EA), and a validity

exam would be required before operations could begin. Estimated cost changes are summarized in the Table E-14.

Table E-14. Alternative 3: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$207,337
Change in Costs under Alternative 3 due to Bonding @5 Total Change in Costs under Alternative 3	1,360 1,360
Total Project Costs under Alternative 3	208,697
Percent Change in Costs from Alternative 1 to Alternative 3	0%
Change in Costs Assuming Plan of Operations Required and Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Bonding Plan Preparation Environmental Assessment Validity Exam Total Change in Costs under Alternative 3	 1,360 2,500 80,000 10,000 93,860
Total Project Costs under Alternative 3	$301,197
Percent Change in Costs from Alternative 1 to Alternative 3	45%

Alternative 4: Maximum Protection

General: Alternative 4 is based on design standards that establish criteria for protecting environmental resources. These types of standards and criteria would affect exploration operations. The elimination of Notices would directly affect an exploration project in bonding, inspection, and enforcement; soil stability; topsoil; drill hole plugging; and revegetation. The need for a validity exam, bonding criteria, fish and wildlife habitat, and wetlands would affect exploration.

This model assumes that the operator would comply with the regulations and therefore pay no penalties. The automatic stay for appeals under Alternative 4 could delay exploration as well as potential future profits if an economic deposit is discovered. Delays are addressed in the following discount cash flow analysis.

Permitting and Environmental Costs: The standards for road construction were developed for well-maintained roads and not for exploration roads. It is assumed that road building will be based on site conditions.

Bonding - Bonding would be as outlined for Alternative 3 but would include more costs for unplanned events (spills, releases, and cleanup). For exploration projects added costs for major environmental problems would probably not need to be addressed except for potential petroleum spills. Any petroleum spill would require removing contaminated soils and trucking them to an approved disposal site for treatment. The potential cost would be added to the bond amount. The exploration model assumes that the operator would place the full amount of the bond into a certified deposit. The operator would again acquire a bond through a bonding company. If the operator can get good company ratings, the bond will cost 2% of the bond amount for 1 year. The total estimated bond amount would be $6,437, and the estimated cost of reclamation would amount to $5,437 for general reclamation as described in Alternative 3, plus $1,000 more for a potential unplanned petroleum spill. The total bond cost is estimated to be $322, or 5% of reclamation costs ($6,437 @ 5% = $322).

Notice Versus Plan Threshold - Under Alternative 4, Notices and all mineral activity, including exploration, would be replaced by Plans of Operations. The cost of developing and reviewing Plans would apply as outlined for Alternative 3. Estimated costs for an exploration project to file a Plan of Operations would total about $82,500 ($2,500 for preparing a Plan of Operations and $80,000 for preparing an environmental assessment of small complexity, with costs borne by the operator).

Inspections - Under Alternative 4 operators would be required to hire third-party contractors to monitor their operations. This project would require three inspections: once during exploration, once during reclamation, and once for final reclamation and clearance. The monitoring would not require an overnight stay, but 10 hours would be needed to get to the site, complete the inspection, and return to the office and complete the report. No samples would be needed for this program. Total estimated costs for inspection would amount to $1,500 (assuming one inspector, three trips, and 10 hours/trip, at $50/hr).

Validity Exams - This provision requires that a validity exam be conducted before a Plan of Operations is approved. This cost would remain the same as outlined for Alternative 3. The average cost to BLM of conducting a validity exam is $10,000. BLM would recover the cost of the validity exam from the operator.

Reclamation Costs: Reclamation for wetlands and fish and wildlife habitat would remain the same for this model as under Alternative 1, No Action. The assumption is that the mining industry overall would be diligent and disturbances would be reclaimed within the 10-year limit. Therefore, no other habitat restoration would be required, and no more costs are assumed.

This is a short-term exploration project, and soil stability design limits would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Water Resources - For the exploration model 50 drill holes would be drilled with a diameter of 5.5 inches. This holes are assumed to be dry. Under Alternative 4 the holes would be plugged with bentonite and 10 feet of cement. Total estimated cement capping costs would amount to $1,250 (assuming 50 holes, 10 feet/hole, at $2.50/linear foot). Total estimated plugging costs would amount to $16,150 (assuming 190 feet/hole, at $1.70/linear foot).

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. The operator would remove the topsoil the same as under the other alternatives, but possible increases in travel time to stockpile locations could decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. These increases would not substantially increase the time needed to remove topsoil.

Under the other alternatives the soil and colluvium would be moved by the earth moving equipment in one or two passes, mixing the material together. The material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. The efficiencies were estimated from the Caterpillar Performance Handbook (Caterpillar, Inc. 1996) as 0.83. For Alternative 4 the efficiency is estimated at 0.75 or about 1 hour difference in the time needed to complete the dirt work. Total estimated added costs for equipment and labor to complete dirt work is $300 (assuming another hour each for one dozer at $120/hr and one tracked excavator at $100/hour, and two equipment operators for 1 hour each at $40/hr).

Revegetation - Under Alternative 4 revegetation would consist of only native species seed planted. The open pit model outlines the seed mixture used under this alternative. All other aspects of seeding the exploration project would remain the same as under Alternative 1 (No Action). Total estimated added costs would be $155 (assuming an added seed mixture cost of about $39/acre for 4 acres).

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn from mineral development, the project would incur the costs shown in Table E-15.

Table E-15. Alternative 4: Change in Costs for Small Exploration Project

Total Project Cost under Alternative 1:	$207,337
Change in Costs under Alternative 4 due to:	
Bonding	322
Plan Preparation	2,500
Environmental Assessment	80,000
Third-Party Monitoring	1,500
Drill hole Plugging	17,400
Topsoil Management	300
Revegetation with Natives	155
Validity Exam	10,000
Total Change in Costs under Alternative 4:	112,177
Total Project Costs under Alternative 4:	$319,514
Percent Change in Costs from Alternative 1 to Alternative 4:	54%

Alternative 5

General: Under Alternative 5 the operation would continue to be processed under a Notice. The only change would be the addition of a bond to the operation. Under this model the bond cost would be as outlined in Table E-16.

Total Estimated Cost Changes:

Table E-16. Alternative 5: Change in Costs for Small Exploration Project	
Total Project Cost under Alternative 1	$207,337
Change in Costs under Alternative 5 due to Bonding @5 Total Change in Costs under Alternative 1	1,360 1,360
Total Project Costs under Alternative 3	$208,697
Percent Change in Costs from Alternative 1 to Alternative 3	<1%

Small Placer Mine

The small placer mine project would be conducted by a small miner with used or borrowed equipment. The model assumes that the operation would disturb ½ mile of a stream. Both the stream channel and the uplands would be mined, and no mercury would be used. Most of these types of operators are people who either work part time at the job or do not pay themselves a salary before calculating profits. The money they make is based on profits from their operations.

Project size:	An estimated 3 acres of disturbance
Production rates:	250 loose cubic yards/year
Mine life:	5 years
Average grade:	$4.00/bank cubic yards @ $300.00/oz
Overburden:	<7 feet
Pay gravel:	< 4 feet
Strip ratio:	1 to 1.75
Equipment use:	Dozer (D6), loader (930), mobile wash plant (hopper, vibrating screens, trommel /sluice box, and concentrating table at 45 cubic yards per day) at 780 gallons per minute of water usage.
Crew:	Two workers
Camp:	On-site small trailers and temporary sheds
Fuel storage:	500 gallon above-ground tank
Permitting:	Notice-level, 15 days to complete; no federal/state joint coordination needed. Note that this operation could require a Plan of Operations if on special category lands.
Reclamation:	Recontouring and revegetation, stream restoration, concurrent with mining.

Permitting and Environmental Costs: Under this operation, the prospector or miner would submit to BLM. the Notice, which would range in size and technical sophistication. Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorization and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

The Notice is usually hand written, includes a map, and would take an estimated 8 hours to compile and provide information to BLM. The estimated cost would be $220, based on $28/hr.

Operation Costs: All the equipment is either owned or borrowed, and no capital expenses are incurred. This model includes no depreciation or other ownership expenses.

On the basis of normal operations, small placer mines would operate for 60, 8-hour days for 480 hours/year of labor. This time is based on the seasonal restriction to placer operations and the small size of the operation.

Labor costs

2 laborers at $28/hr for 5 years	$134,400

Operating Cost

Equipment	
fuel	$6,720/yr for 5 years
Maintenance	$13, 861/yr for 5 years
Supplies	$10,000/yr for 5 years
Total	$152,905

Reclamation Costs: Placer mining is a form of strip mining that usually operates within stream channels. The area would be recontoured concurrently with the production of gravels. The overall size of the operation would be 12 acres, but at the end of the operation only 6 acres should be reclaimed. The operation would require more reclamation for repairing any stream channels and restoring habitat. The mine would include sediment ponds and other sediment and control structures.

Stream Restoration - There are few references for the costs of stream restoration. This model used published data from EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991). The figures listed in this document are assumed to cover regrading and stream recontouring, topsoil placement, revegetation, and wildlife work. Topsoil is required only on the floodplain and would not be spread in the channel. Seeds would be broadcast by hand. Stream restoration would include establishing vegetation, reconstruction, and building habitat structures. The channel dimensions would be 2 feet deep by 8 feet wide by 1 mile long at a 3% slope.

The documentation for reclamation shows several costs, depending on the type of work completed. Table 12 of EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows the cost of stream and floodplain reconstruction to be $7 to $17/foot. This model assumes $10/ft for wildlife and fish restoration.

Chemical Stabilization - The mine would use no chemicals that involve closure issues. Sediments would be reclaimed during recontouring.

Structure Removal - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene (HDPE) pipelines used by the project. The model assumes that three workers would take 5 days to remove the facilities. The complete operation is portable and can be easily transported.

Table E-17. Placer Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting Plan Preparation	Miner working for eight hours		$220
Permitting Total			$220
Placer Mining Activity: Capital Cost Operating Cost - Labor Operating Cost - Exploration Activity Total			 134,400 152,905 $287,305
Reclamation: Stream Restoration	Based on EPA Reference	10/foot	26,500
Structural removal Equipment Mob/Demob Labor Reclamation Total	2.5 Ton Truck for 10 Days 1 Tracked Excavator (Cat 231d) -10 Hrs 2 Vehide 2 Person Crew for 5 Days at 10 Hours/day	60/day 100/hr 500 27/hr	300 1000 1000 2,800 31,600
Total Cost of Placer Project			$319,320

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations assume that the state program is closely based on current State of Nevada regulations, with a few differences. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements.

Permitting and Environmental Costs:

Notice Preparation - The operator would have to submit something comparable to a Notice to the state but not to BLM. The operator would still produce a Notice, but the Notice would not be subject to environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Costs:

Stream Restoration - This analysis assumes that the state would require reclamation. The company would have to reclaim any disturbance resulting from its operation, but reclamation would not require restoring wildlife and fisheries habitat.

The documentation for restoration shows several costs, depending on the type of work completed. Table 12 in EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction to be $7 to 17/foot. Assuming that wildlife and fisheries habitat would not be restored, the cost would be $7/foot.

Total Estimated Cost Changes: Total cost savings for this placer project under Alternative 2 are summarized in Table E-18.

Table E-18. Alternative 2 -- Changes in Costs for Placer Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$319,320
Change in Costs under Alternative 2 Due to Change in Stream Restoration Cost	(7,920)
Total Change in Costs under Alternative 2	(7,920)
Total Project Cost under Alternative 2 (State Management)	$311,400

Percent Change in Costs from Alternative 1 to Alternative 2	-3 %

Alternative 3: Proposed Action

General: Under the Proposed Action all mining operations would be required to submit a Plan of Operations. Bonding and a potential validity exam would add cost to the placer mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards.

The performance standards are basically being followed at this time. For this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Costs: Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and are shown in Table E-19.

Plans of Operations - The operation would require a Plan of Operations. Under the Proposed Action all mining would be required to submit a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The Proposed Action would strengthen bonding to include the bonding of Plans at 100% of reclamation cost. Bonding would be used to reclaim sites if operators could not complete their reclamation obligations. The bond amount would change to cover the estimated cost to reclaim the operation. This model assumes that the operator is buying an annuity bond, paying insurance premiums that would cost 5% of the bond amount.

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action. This analysis assumes that BLM will require cost recovery.

Reclamation Cost:

Stream Restoration - Table 12 of the EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction costs to range from $7 to 17/foot. For the Proposed Action the analysis assumes

$17/ft for meeting the wildlife and fish restoration standards, costing the operator in an additional $36,900.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-19.

Table E-19. Alternative 3 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$319,320
Change in Costs under Alternative 3 due to Plan of Operation	2,500
Change in Costs under Alternative 3 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 3 due to Bonding	
5% for 10 yrs	$7,900
Change in Costs under Alternative 3 due to Reclamation	18,380
Total Change in Costs under Alternative 3	108,780
Total Project Costs under Alternative 3	428,100
Percent Change in Costs from Alternative 1 to Alternative 3	34%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$438,100
Percent Change in Costs from Alternative 1 to Alternative 3	37%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would directly affect placer mining: bonding, inspection and enforcement, replacing topsoil, protecting fish and wildlife habitat and wetlands, and revegetation. The automatic stay for appeals under Alternative 4 would delay placer mining and result in the costs of lost time and the delay of potential future profits. Delays are addressed in the following discount cash flow analysis.

The soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but this model assumes that no additional costs would be needed for erosion control blankets above erosion and sediment control structures.

Permitting and Environmental Costs:

Bonding - Bonding would be as outlined for Alternative 3 but would include extra money for major environmental events. For placer projects other than petroleum spills, added costs would

not need to be addressed for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite.

For Alternative 4 the model assumes that the operator will build an oil treatment facility onsite to handle all spills from the operation. The model also assumes that the operator would purchase an annuity bond from an agency, paying an insurance premium that would cost an estimated 5% of the bond amount. This amount would be the same as under Alternative 3.

Inspections - Under Alternative 4 operators would have to hire third-party contractors quarterly to monitor their operations. The contractor would complete the inspection and prepare the report in a 10-hour day but would not take environmental samples. The contractor would conduct the monitoring program for the 10 years of the mine operation at an average salary of $50/hour.

Validity Exams - Alternative 4 would require BLM to conduct a validity exam before approving a Plan of Operations. This analysis assumes that these costs would be passed on to the operator.

Reclamation Costs:

Stream Restoration - Because of Alternative 4's set design standards, the restoration of riparian areas would be extensive. The handling of topsoil would require more time because of the loss in equipment efficiency. Revegetation would require the exclusive use of native species, and wetlands would have to be in properly functioning condition within 10 years. The model assumes that both the stream and the uplands would be disturbed. For riparian areas and wetlands to reach properly functioning condition and to meet wildlife and fishery habitat needs, more restoration would be required.

EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows that the cost of restoring a stream and upland areas can vary greatly. The cost of total stream and floodplain reconstruction with fisheries can cost from $28 to $47/foot. For Alternative 4 the model assumes that total stream and floodplain restoration would be needed and that restoration would cost $28/foot, an amount that includes restoring fisheries to meet the 10-year requirement for properly functioning condition for riparian lands and fisheries use.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn from the mining laws, the project would incur the costs shown in Table E-20.

Table E-20. Alternative 4 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1:	$319,320
Change in Costs under Alternative 4 due to:	
Stream Restoration	47,420
Third-Party Monitoring	10,000
Change in Costs under Alternative 4	2,500
Change in Costs under Alternative 4 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Bond	1,580
Validity Exam	10,000
Total Change in Costs under Alternative 4	164,000
Total Project Costs under Alternative 4	$483,320
Percent Change in Costs from Alternative 1 to Alternative 4	51%

Alternative 5

General: Under Alternative 5 all mining operations would be required to submit a Plan of Operations and post a bond. The performance standards are basically being followed at this time. For this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no added cost of erosion control blankets would be needed above erosion and sediment control structures.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-21.

Table E-21. Alternative 5 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$319,320
Change in Costs for Alt.5 due to Plan of Operation	2,500
Change in Costs under Alternative 5 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 5 due to Bonding @ 5% for 10 yrs	$7,900
Change in Costs under Alt.5 due to Reclamation	18,380
Total Change in Costs under Alternative 5	$108,780
Total Project Costs under Alternative 5	$428,100
Percent Change in Costs from Alternative 1 to Alternative 5	34%

Placer Model

The placer operation would be conducted by a medium-size mining company. The model assumes the operation is for precious metals, gold. The operation would disturb 1 mile of stream, including the stream channel and uplands. No mercury would be used onsite.

Resource size:	1,000,000 bank cubic yards
Production rate:	500 loose cubic yards per day
Mine life:	10+ years
Average grade:	$4 per bank cubic yards @ $300/oz.
Overburden:	< 14 feet
Pay gravel:	<4 feet
Equipment used:	Dozer (D8), Excavator (235), mobile washplant (hopper, vibrating screen, 4' x 30' single sluice, 1200 g.p.m. water use)
Crew:	3 workers
Camp:	One-site small trailers and temporary sheds
Fuel storage:	1,000 gallons in portable tanks with spill containment, biotreatment facility onsite
Permitting:	Environmental assessment completed, 2 months to complete, joint state coordination
Reclamation:	Recontouring and revegetation, stream restoration, concurrent with mining

Note: This operation would require some recontouring of waste rock. The waste piles would be both in the old part of the pit and out of the pit at a 2:1 slope.

Permitting and Environmental Costs: Permitting and environmental costs are hard to

determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and are shown in Table E-22.

Plans of Operations - The operation would be filed under a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The model assumes that the operator is buying an annuity bond from an agency and paying an insurance premium that would cost an estimated 5% of the bond amount per year. The model further assumes that the operator has a good credit rating and has the assets to back the bond. The bond would be assessed at 5% for 10 years and would cost $3,225.00.

Reclamation Costs: Placer mining is a form or strip mining that usually operates within stream channels. The area would be recontoured concurrently with the production of the gravels. The overall size of the operation would be 12 acres, but at the end of the operation only 6 acres would be reclaimed. The operation would require more reclamation for repairing any stream channels and restoring habitat. The mine would include sediment ponds and other sediment and control structures.

Stream Restoration - There are few references for the costs of stream restoration. This model used published data from EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991). The figures in this document are assumed to cover regrading and stream recontouring, topsoil placement, revegetation, and wildlife work. Topsoil is required only on the floodplain and would not be spread in the channel. Seeds would be broadcast by hand. Stream restoration would include establishing vegetation, reconstruction, and building structures for habitat. The channel dimensions would be 2 feet deep by 8 feet wide by 1 mile long at a 3% slope.

The documentation for reclamation shows several costs, depending on the type of work completed. Table 12 of EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows the cost of stream and floodplain reconstruction to be $7 to $17/foot. This model assumes $10/ft for wildlife and fish restoration.

Chemical Stabilization - The mine would use no chemicals that involve closure issues. Sediments would be reclaimed during recontouring.

Structure Removal - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene (HDPE) pipelines used by the project. The model assumes that three workers would take 10 days to remove the facilities. The complete operation is portable and can be easily transported.

Table E-22. Placer Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting Plan Preparation	Two People 5 Days with Computer Support		$2,500
EA preparation			80,000
	Includes Wetlands study	5,000	
	Restoration/reclamation plan	5,000	
	Wildlife/fisheries studies	10,000	
	Cultural survey	10,000	
	Bond Cost	5% for 10	32,250
Permitting Total		yrs	114,750
Placer Mining Activity:			
Capital Cost			250,000
Operating Cost - Labor			425,000
Operating Cost - Equipment			300,000
Exploration Activity Total			$975,000
Reclamation:			
Stream Restoration	Based on EPA Reference	10/foot	52,800
Structural removal			
Equipment	2.5 Ton Truck for 10 Days	60/day	600
	1 Tracked Excavator (Cat 231d) -20	100/hr	2000
Mob/Demob	Hrs	500	1000
	2 Vehicle		
Labor		27/hr	8,100
	3 Person Crew for 10 Days at 10		
Reclamation Total	Hours/day		64,500
Total Cost of Placer Project			$1,154,250

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Alternative 2 is based on the states taking over the surface management of mining on public lands. Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations would be based on the assumptions that the state program would based on current BLM regulations. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements.

This analysis assumes that the state would require a Plan of Operations, reclamation, the posting of bond, and monitoring for compliance, but no environmental review for such aspects of the

project as cultural resources, cave resources, and wildlife.

Permitting and Environmental Costs:

Plan of Operations Preparation - The operator would have to submit a Plan to the state but not to BLM. The operator would still produce a Plan of Operations, but the Plan would not be subject to environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Costs:

Stream Restoration - This analysis assumes that the state would require reclamation. The company would have to reclaim any disturbance resulting from their operation, but reclamation would not require restoring wildlife and fisheries habitat.

The documentation for restoration shows several costs, depending on the type of work completed. Table 12 in EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction to be $7 to 17/foot. Assuming that wildlife and fisheries habitat would not be restored, the cost would be $7/foot.

Total Estimated Cost Changes: Total cost savings for this placer project under Alternative 2 are summarized in Table E-23.

Table E-23. Alternative 2 -- Changes in Costs for Placer Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$1,154,250
Change in Costs under Alternative 2 Due to Elimination of Environmental Review Change in Stream Restoration Cost Total Change in Costs under Alternative 2	 (80,000) (15,840) (95,840)
Total Project Cost under Alternative 2 (State Management)	$1,058,410
Percent Change in Costs from Alternative 1 to Alternative 2	- 1%

Alternative 3: Proposed Action

General: Direct cost increases to the operator would be minimal because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation.

Under the Proposed Action the soil stability design limit would not be approached because of

reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Under the Proposed Action, bonding and a potential validity exam would add cost to the Placer Mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards.

Permitting and Environmental Cost:

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action.

Reclamation Cost:

Stream Restoration - Table 12 of the EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows stream and floodplain reconstruction costs to range from $7 to 17/foot. For the Proposed Action the analysis assumes $17/ft for meeting the wildlife and fish restoration standards. Meeting these standards would result in an additional cost to the operator of $36,900.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-24.

Table E-24. Alternative 3 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$1,154,250
Change in Costs under Alternative 3 due to Reclamation	36,900
Total Change in Costs under Alternative 3	36,900
Total Project Costs under Alternative 3	1,191,150
Percent Change in Costs from Alternative 1 to Alternative 3	7%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$1,201,150
Percent Change in Costs from Alternative 1 to Alternative 3	8%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would affect placer mining. Bonding, inspection and enforcement, replacing topsoil, protecting fish and wildlife habitat and wetlands, and revegetation would directly affect placer mining.

The automatic stay for appeals under Alternative 4 would delay placer mining and result in the costs of lost time and the delay of potential future profits. The cost of delays are addressed in the following discount cash flow analysis.

The soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but this model assumes that no added costs would be needed for erosion control blankets above erosion and sediment control structures.

Permitting and Environmental Costs:

Bonding - Bonding would be as outlined for Alternative 3 but would include extra money for major environmental events. For placer projects other than petroleum spills, added costs would not need to be addressed for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite.
For Alternative 4 the model assumes that the operator will build an oil treatment facility onsite to handle all spills from the operation. The model also assumes that the operator will purchase an annuity bond from an agency, paying an insurance premium that would cost an estimated 5% of the bond amount. This amount would be the same as under Alternative 3.

Inspections - Under Alternative 4 operators would have to hire third-party contractors quarterly to monitor their operations. The contractor would complete the inspection and prepare the report in a 10-hour day but would not take environmental samples. The contractor would conduct the monitoring program for the 10 years of the mine operation at an average salary of $50/hour.

Validity Exams - Alternative 4 would require BLM to conduct a validity exam before approving a Plan of Operations.

Reclamation Costs:

Stream Restoration - Because of Alternative 4's needs to set design standards, the restoration of riparian areas would be extensive. The handling of topsoil would require more time because of the loss in equipment efficiency. Revegetation would require use of native species, and the wetlands would have to be in properly functioning condition within 10 years. The model assumes that both the stream and the uplands would be disturbed. For riparian areas and wetlands to reach properly functioning condition and to meet wildlife and fishery habitat needs, more restoration would be required.

EPA's *Handbook for Reclamation of Placer Mined Stream Environments in Western Montana* (INTER-FLUVE, Inc. 1991) shows that the cost of restoring a stream and upland areas can vary greatly. The cost of total stream and floodplain reconstruction with fisheries can cost from $28 to $47/foot. For Alternative 4 the model assumes that total stream and floodplain restoration would be needed and that restoration would cost $28/foot, an amount that includes restoring fisheries to meet the 10-year requirement for properly functioning condition for riparian lands and fisheries use.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn from the mining laws, the project would incur the costs shown in Table E-25.

Table E-25. Alternative 4 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1:	$1,154,250
Change in Costs under Alternative 4 due to:	
Stream Restoration	$110,880
Third-Party Monitoring	$20,000
Bond	$10,000
Validity Exam	$10,000
Total Change in Costs under Alternative 4	$150,880
Total Project Costs under Alternative 4	$1,305,130
Percent Change in Costs from Alternative 1 to Alternative 4	+ 13%

Alternative 5

General: Cost increases to the operator would be minimal because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation. Under Alternative 5, bonding would add cost to the placer mine model. Other reclamation costs would be needed to complete the requirements of higher wildlife and wetland standards. The cost would be the same as outlined for Alternative 3.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-26.

Table E-26. Alternative 5 -- Change in Costs for Placer Project	
Total Project Cost under Alternative 1	$1,154,250
Change in Costs under Alternative 5 due to Reclamation	$36,900
Total Project Costs under Alternative 5	$1,191,150
Percent Change in Costs from Alternative 1 to Alternative 5	7%

Strip Mining/ Industrial Mineral Model

This strip mine is being operated by a medium-sized industrial mineral organization. This mine is the organization's main source and directly supplies an operating mill and production facility. This model is organized after a gypsum operation.

Resource size:	1 million tons
Production rate:	250 tons per day
Mine life:	10+ years
Overburden:	4 feet, no waste rock expected
Pay layer:	4 feet
Equipment used:	Dozer (D8), excavator (235), front-end loaders, rear dump trucks, road graders, percussion drill, stationary washplant (hopper, vibrating screen, concentration/flotation mill, 1200 gpm water use)
Crew:	15 workers
Housing:	Nearby towns
Fuel:	5,000 gallons in portable tanks
Permitting:	Environmental assessment completed, 3 months to complete, joint state-federal coordination
Reclamation:	Recontouring and revegetation concurrent with mining

Note: This model assumes an industrial mineral, little overburden that is not reclaimed in the strip mining process, and a petroleum biotreatment facility onsite for cleaning up petroleum spills. A construction waste landfill is also onsite.

Permitting and Environmental Cost: Permitting and environmental costs are hard to determine by a generalized method. The cost of permit authorizations and environmental documentation greatly vary by site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a broad range. The following costs were derived from information obtained from several mining companies and consultant firms. These costs were averaged and are described below.

Plans of Operations - The operation would file a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/ reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The bonding of the operation would be at the maximum of $2,000/ac. This model assumes that the operator is purchasing an annuity bond and paying an annual insurance premium of 5% per year for 10 years. The model further assumes that the operator has a good credit rating and has the assets to back up the bond. The bond amount for this project is $65,000.

Reclamation Cost:

Earthwork - The model assumes that strip mining methods are used to extract most industrial minerals even though strip mining is only one of several ways industrial minerals are mined. The basic model is for bentonite- and gypsum-type deposits. No chemicals would be used to process the material, and the material's final processing is offsite. The earthwork would consist of recontouring and covering with topsoil the roads, ancillary facilities, and the last strip pit. Strip mining applies ongoing concurrent reclamation, with each mined strip being refilled with the waste rock from the next pit and covered with topsoil. The calculations, therefore, address only the final phase of earth work and revegetation for the operation.

Cost of regrading.

Production rate	
Equipment	D9N. and U Blade
Average dozing distance	270 ft
Production	300 yd^3/hr
Correction factors	
Operator average	0.75
Material - loose stockpile/.ripped or blasted	1.20 or .08
Type dozing - slot to side by side	1.20
Job efficiency	0.83
Weight correction	0.83
Hourly Production rate	223 yd^3/hr
Cost Rates	
Bulldozing (D9N)	$155/hr
Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	10	1,200	54	$18,390	$2,160
Roads*	40	10,000	448	$69,440	$17,920
Ancillary Facilities	15	15,000	67	$19,385	$2,680
Cost of Recontouring				$107,215	$22,760

*Assumption that ripping production is the same as blading work.

Cost of applying top soil. Apply growth medium to an average thickness of 6 inches, using a scraper.

Production rate	
Equipment	615 Scraper
Capacity	16 yd^3

Average haul distance	1000 ft
Cycle time	
Cycles per hour	13.33 cycles/minute
Correction factors	
Load factor	0.9
Job efficiency	0.83
Eff. Load capacity	14.4 yd^3
Hourly production	159.4 yd^3/hr
Cost Rates	
615 scraper	$100/hr
Operator	$ 40/hr

From the above data, the following table estimates equipment and labor costs for applying topsoil.

	Acres	Cubic yards	Hours	Equipment cost	Labor cost
Waste Rock	10	24,200	152	$15,200	$6,080
Roads	40	96,800	608	60,800	24,320
Ancillary Facilities	15	36,300	228	22,800	9,620
Cost of applying topsoil				$98,800	40,020

Revegetation - Revegetation would require scarifying and preparing the ground for seeding. Seeds would be planted with drill seeding equipment. Aspects of wildlife habitat enhancement and wetland reclamation would be included in revegetation.

Production rates	
Equipment	14-G grader with scarifier
Scarifying width	10 feet
Operating speed	1.0 mph
Production rate	1.0 hr/ac
Equipment	Small tractor and seed drill
Seeding width	10 feet
Operating speed	2.5 mph
Production rate	0.33 hr/ac
Travel length	4356 ft/ac
Cost rates	
Tractor and seed drill	$50/hr
14-G Grader	$80/hr
Operator - grader	$40/hr
Labor (2)	$27/ac

Seed Mixture

Species	$/lb (PLS)	Drilled rate (lbs.)	Price/ac
Slender Wheatgrass	$1.25/lb	3	$3.75
Western Wheatgrass	$3.00/lb	2	$6.00
Fourwing Saltbrush	$8.00/lb	1	$8.00
Yellow Sweetclover	$0.60/lb	0.5	$0.30
Basin Wildrye	$5.60/lb	1	$5.60
Shadscale	$6.50/lb	2	$13.00
Small Burnett	$0.90/lb	2	$1.80
Thickspike Wheatgrass	$8.25/lb	0.5	$4.15
Prostrate Kochia	$17.50/lb	0.25	$4.40
Sainfoin	$1.40/lb	2	$2.80
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$56.30/ac

Using the above data, the following table estimates equipment and labor costs for revegetation.

	Acres	Hours	Equipment Cost ($)	Labor Cost ($)
Waste Rock	10	10 hrs grader 3 hrs drill	800 150 563	400 162
Roads	40	40 hrs 13 hrs	3,200 650 2,252	1,600 202
Ancillary Facilities	15	15 hrs 5 hrs	1,200 250 844	600 270
Revegetation Cost			9,909	3,234

Removal of Structures - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 30 days to remove the facilities and bury the foundations.

Table E-27. Industrial Mineral Mine Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting			
Plan Preparation	Two people five days, w/ computer support		$2,500
EA Preparation			$80,000
	Includes: Wetlands study	$5,000	
	Restoration and reclamation	$5,000	
	Wildlife/fisheries studies	$10,000	
	Cultural survey	$10,000	
Bond Cost	Estimated bond $24,000	5% for 10	$65,000
Permitting Total		yrs	$147,500
Open Pit Operation:			
Capital Cost			$400,000
Operating Cost - Labor			$1,800,000
Operating Cost - Equipment			$240,000
Exploration Activity Total			$2,440,000
Reclamation:			
Earth Work			
Regrading			
Equipment*:	D9N Dozer	$155/hr	$107,000
Labor*:	operator	$40/hr	$22,760
Applying top soil			
Equipment*:	615 Scraper	$100/hr	$98,800
Labor*:	operator	$40/hr	$40,080
Revegetation			
Equipment*	: 14-G Grader	$80/hr	
	Small Tractor and seed drill	$50/hr	$10,000
	Seed mixture	$56.30/ac	
Labor*:	Grader operator	$40/hr	
Total earth work and revegetation	2 laborers	$27/hr	$3,234 *$282,000*
Structural removal	2.5 ton truck for 80 days	$60/day	
Equipment	Ho-lift equipment, 24ft boom-7.7mt lift	$165/day	
	D9N Dozer for 2 days	$155/hr	$7,370
Labor	5 person crew for 80 days at 8 hours/day	$27/hr	$32,400
Total Structural removal			*$39,770*
Reclamation Total			$321,800
Total Cost of Project			$2,909,300

*See estimated time to complete task in the information above.

Alternative 2: State Management

General: Determining the costs of the State Management Alternative for all of the states in the

EIS study area would not be practical for this exercise. Therefore, the following cost calculations assume that the state program is based on current State of Nevada regulations. A review of the state programs reveals that they are similar in requirements for posting bond for reclamation, surface and ground water, and reclamation.

This analysis assumes that the state would require that a Plan of Operations be submitted. The state would still require reclamation, the posting of bond, and monitoring for compliance. The analysis further assumes that no environmental review of the project would be required for cultural resources, cave resources, or wildlife.

Permitting and Environmental Cost:

Plans of Operations - The operator would have to submit a Plan of Operations to the state but not to BLM. The project would not undergo environmental review, and the operator would not have to pay for an environmental assessment.

Reclamation Cost: Reflecting general state programs, reclamation is required for soil and slope stabilization only. Therefore, this analysis assumes that the state would require only grasses for soil stability and that wildlife and fisheries habitat would not have to be restored. The company would have to reclaim any disturbance caused by the operation.

The seed mixture under Alternative 2 would contain the following grasses:

Seed Mixture:

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2 lbs	$6.00/ac
Basin Wildrye	$5.60/lb	1 lb	$5.60/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Sandberg Bluegrass	$26.00/lb	0.25 lb	$13.00/ac
		Total	$32.50/ac

The following cost calculations show the cost for the seed mixture under Alternative 2.

Waste Rock	10 acres		$325.00
Roads	40 acres		$1,300.00
Ancillary Facilities	15 acres		$487.50
		Total	$2,112.50

Total Estimated Cost Changes: Total cost savings for this strip mine under Alternative 2 are summarized in Table E-28.

Table E-28. Alternative 2 -- Changes in Costs for a Industrial Mineral Mine Project	
Total Project Cost under Alternative 1 (Existing regulations)	$2,909,300
Change in Costs under Alternative 2 due to Elimination of Environmental review Change in Seed cost Total Change in Costs under Alternative 2	 (80,000) (1,500) (81,500)
Total Project Cost under Alternative 2 (State Management)	$2,827,800
Percent Change in Costs from Alternative 1 to Alternative 2	- 3%

Alternative 3: Proposed Action

General: Under the Proposed Action more costs could be required because of common variety determination. Impacts to the industry, however, would be minimal because BLM and industry are generally following these procedures in authorizing operations and reclamation. Any operation within a mineral withdrawal area would have the additional cost in time and money to complete a validity exam of the claims. These types of actions, however, would not occur often and for this model are assumed to involve no cost.

For this project the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Cost:

Bonding - The bonding of the operation would become 100% of the reclamation costs. For this operation the cost of reclamation is $321,800. A bond at 5% for 10 years would cost $161,000.

Common Variety Determinations - Common variety determinations could be required for industrial mineral operations. This determination would verify that the mineral is locatable under the Mining Law or salable under the Mineral Materials Act of 1947.

Average cost = $30,000 per examination.

The cost to the operator is assumed to be $30,000 for preparation work for BLM. The analysis assumes that 10% of the exploration model and 50% for the strip mining activities would require this added cost.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-29.

Table E-29. Alternative 3 -- Change in Costs for an Industrial Mineral Mine Project	
Total Project Cost under Alternative 1	$2,909,300
Bond changes between Alternative 3 and 1.	$96,000
Total Project Cost under Alternative 3	$3,005,200
Percent Change in Costs from Alternative 1 to Alternative 3	3%
Change in Costs Assuming Validity Exam Is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	$30,000
Total Project Costs	$3,035,200
Percent Change in Costs from Alternative 1 to Alternative 3	4%

Alternative 4: Maximum Protection

General: Under Alternative 4, bonding, inspection and enforcement, soil stability, topsoil, and revegetation would directly affect strip mining.
The waste rock design and road designs would be incorporated into the mine design and would not usually involve major costs. This model assumes that Alternative 4 would incur no more costs for road and slope stability design standards.

The acid rock drainage testing would be completed during the environmental review. The model assumes that the kinetic test would be included in the review. No other tests would be run unless acid generation potential changes from the rock types tested.

Permitting and Environmental Cost:

Bonding - Bonding would not change from that outlined for the Proposed Action except that more money would be added. for major environmental events Other than for petroleum spills, strip mines would not need to address added costs for major environmental problems. Any petroleum spill would require removing the contaminated soils and trucking them to an approved disposal site for treatment. No other chemicals are expected to be used onsite. This model assumes that the operator would build an oil treatment facility onsite and this site would handle all spills from the operation.

Inspections - Operators would be required to hire third-party contractors to monitor their operations. Monitoring the operation quarterly, the contractor could complete the inspection and prepare the report in a 10-hour day. No environmental samples would be collected.
Common Variety Determinations - For industrial minerals common variety determination and validity exams would be required to determine if the mineral is locatable under the Mining Law or salable under the Mineral Materials Act of 1947. Common variety determinations would be

required under the reclamation and strip mining models. The average cost per examination is $30,000. An operation would have an unknown cost if a claim is in production and production is lost due to the claimant's assisting BLM in the exam. This model assumes that industry would carry the cost to complete the project.

Reclamation Cost:

Earth Work - Under Alternative 4 the topsoil would be removed by soil horizons. The operation would remove the topsoil just as under other alternatives, but increased travel times to stockpile locations would decrease the efficiency of the earth moving equipment by not allowing blades to cut as deeply as possible. But the increased travel times would not be so great as to double the time needed to remove the topsoil.

Under the other alternatives, earth moving equipment would move the soil and colluvium in one or two passes, mixing the material together. The material would then be removed into different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. The efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the efficiency would be estimated at 0.75. This time amounts to about 1 hour difference in the time needed to complete the dirt work.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.75
	Eff. Load capacity	10.8 yd^3
	Hourly production	144 yd^3/hr
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Quantity	Hours	Equipment Cost	Labor Cost
Waste Rock	10	24,200	168	$16,800	$6,720
Roads	40	96,800	672	67,200	26,880
Ancillary Facilities	15	36,300	252	25,200	10,080
Cost of Applying Topsoil				109,200	43,680

Revegetation - Under Alternative 4 only native species could be used in revegetation. The open pit model outlines the seed mixture that would be used by this alternative. All other aspects of seeding the strip mine project would remain the same. Using the above data, the following table estimates equipment and labor costs for revegetation.

	Acres	Time	Equipment Cost	Labor Cost
Waste Rock	10	10 hrs grader 3 hrs drill total	$800 150 950	$400 162
Roads	40	40 hrs 13 hrs total	3,200 650 3,800	1,600 202
Ancillary Facilities	15	15 hrs 5 hrs total	1,200 250 1,425	600 270
Cost of Revegetation			12,425	$3,234

Soil Stability - To meet the stability standard for Alternative 4, more measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes, the project would need erosion control blankets on the waste rock piles (20 acres) and the roads (20 acres) for a total of 40 acres. Erosion control blankets cost $\$0.45/yd^2$, and the project would cost $87,120.

Wetlands - Under Alternative 4 all wetlands must be restored within 10 years after final closure and reclamation of an operation. If this restoration is not possible, then 1.5 times the amount of the area disturbed or lost would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit operations do remove wetlands in placing the pit and waste rock dumps. This model assumes that 10 acres of wetlands would be lost with the replacing of waste rock dumps.

Offsite mitigation is estimated to cost the same as stream restoration under Alternative 4 of the

placer mining model. For alternative 4 the model assumes $2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for properly functioning condition for wetlands. A stream restoration cost of $2,500/acre was used for this alternative. The project would reclaim 15 acres at a cost of $37,500.

Total Estimated Cost Changes: If the exploration operation is not in an area withdrawn for minerals, the project would incur the costs shown in Table E-30.

Table E-30. Alternative 4 -- Change in Costs for an Industrial Mineral Mine Project

Total Project Cost under Alternative 1:	$2,909,200
Change in Costs under Alternative 4 due to:	
Third-Party Monitoring; 40 hrs at $50/hr/year for 10 years	20,000
Applying Top Soil	152,880
Bonding	96,000
Re-vegetation Cost	2,516
Soil Stabilization	87,120
Validity Exam	30,000
Wetland Restoration	37,500
Total Change in Costs under Alternative 4:	426,000
Total Project Costs under Alternative 4:	$3,335,200
Percent Change in Costs from Alternative 1 to Alternative 4:	15%

Alternative 5

General: Under Alternative 5 more costs could be required because of common variety determination. Impacts to the industry, however, would be minimal because BLM and industry are generally following these procedures in authorizing operations and reclamation. Any operation within a mineral withdrawal area would have the additional cost in time and money to complete a validity exam of the claims. These types of actions, however, would not occur often and for this model are assumed to involve no cost. No validity exam would be required before the operation can begin.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-31.

Table E-31. Alternative 5 -- Change in Costs for an Industrial Mineral Mine Project	
Total Project Cost under Alternative 1	$2,909,300
Bond changes between Alternative 5 and 1.	$96,000
Total Project Cost under Alternative 5	$3,005,200
Percent Change in Costs from Alternative 1 to Alternative 5	3%

Small Underground Mine Operation

This underground operation disturbs less than 5 acres and processes ore in a small heap leach operation. This operation is standard for very small mining companies and individual miners. The operation is uses two 1,000-foot inclined shafts at a 45° angle

Resource size:	100,000 tons
Production rate:	30 tons per day
Mine life:	3 years mining and 2 years reclamation
Average grade:	0.55 oz. per ton @ $300/oz.
Stope dimensions:	100ft x 100ft x 50ft
Equipment used:	Single leg drill, LHD-3.5 cu. yd.,single compressor ventilation system one maintenance trucks, 2@25 KW generators, and two pickups for mining.
Fuel:	two 500 gallon above ground tanks with leak detection system.
Processing:	The operation uses conventual heap leach technology. Chemicals used for this process are on the site. A construction material dump is onsite, and a bio-remediation facility is onsite to process minor petroleum spills.
Crew:	5 workers
Housing:	Nearby towns
Permitting:	Joint federal/state coordination, cultural field studies
Reclamation:	Postmining recontouring and revegetation, stream restoration, water stabilization and recharge, chemical stabilization, wildlife reclamation projects

The development of an underground mine is extensive and costly. For this operation it is assumed that the operator is a small miner who owns or is borrowing most of the equipment to do the work. The operator does not receive a salary but gains any profits from mining the ore.

Permitting and Environmental Costs: Under this operation, the prospector or miner would submit a Notice to BLM. The document (Notice) will range in size and technical sophistication. Permitting and environmental costs are difficult to determine by a generalized method. The costs of permit authorization and environmental documentation vary greatly because of site-specific conditions. Depending on the ore body sought, its location, and other local environmental conditions, the cost can cover a broad range.

The Notice is usually hand written, includes a map, and would take an estimated 8 hours for 3 days to compile and provide information to BLM. The estimated cost would be $660 based on $28/hr.

Capital Cost: These capital costs are from *Mining Cost Service* (Western Mine Engineering, Inc. 1997b) for end slice mining method adit entry (800tons/day). The costs were proportionally reduced for this model's production (100tons/day) and reserves. The leaching cost were developed from Mine Cost Service from the Gold Heap Leaching paper, C1.

Mine Development Cost		Leach Facility Cost	
Adit	$99,375	Surface facilities site clean up	
Drift	$13,650	4.5 acres @ $3,000	$13,500
Cross Cut	$3,512		
Ore pass	$4,170	Leach Field	$28,237
Vent	$23,100	Recovery	$1,000
		Utilities	$9,000

Equipment: It is assume that the operator owns the load, dump, and haul (LHD); single leg drills; ventilation system; generators; utility vehicles; and any other startup equipment.

Total cost is $200,000.

Operation Cost:

Based on the Mining Cost Service's model (Western Mine Engineering, Inc. 1997b), supplies cost $4.97/ton. For this operation we used $1.00/ton, which is an estimated proportional cost for the mining and an estimated $1.00/ton for heap leach supplies. This would give us a total of $200,000 for supplies.

The equipment costs, except for the ventilation system, are based on 250 working days. The operator would not have a full crew, and employees would be switching jobs from one day to the next. Production would be maintained at an average of 100 tons/day.

LHD	$25.00/hr	$187,500.00
Drills	$0.40/hr	$3,600.00
Ventilation System	$0.60/hr	$5,400.00
Utility Vehicles	$6.62/hr	$1,700.00

Labor cost are variable, depending on whether the operator is paying wages or employees expect to get their wages from the operation's profits. For this model the operator is paying wages to six employees, all of which can do any of the jobs at the mine and leach facility. On average, the mine could produce 100 tons/day.

6 Miners	$28/hr @ 10hr/day @ 300days/yr @ 3 years	$252,000

Reclamation Cost: This model assumes that the waste rock dump and the leach pad would be regraded with a D6 cat with a U blade.

Chemical Stabilization - Chemical stabilization would involve neutralizing the cyanide content of the heap leach pads and processing facilities. Operating costs would include any capital items such as pumps, piping, maintenance, and power. Costs for materials include the use of chemicals. The following figures were derived from submitted bond calculations and actual numbers from operations that have met closure. This reclamation involves heap flushing with water only. No other chemicals are added.

Cost of regrading and top soiling:

Production rate	
Equipment	D6N. and U Blade
Average dozing distance	270 ft
Production	300 yd^3/hr
Correction factors	
Operator average	0.75
Material - loose stockpile/.ripped or blasted	1.20 or .08
Type dozing - slot to side by side	1.20
Job efficiency	0.83
Weight correction	0.83
Hourly Production rate	223 yd^3/hr
Cost Rates	
Bulldozing (D9N)	$150/hr
Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	1	200	1	$150	$40
Ancillary Facilities	4	1,500	6	$900	$240
Cost of Recontouring				$1050	$280

Revegetation - Revegetation would require scarifying and preparing the ground for seeding. Seeds would be planted with drill seeding equipment. Aspects of wildlife habitat enhancement and wetland reclamation would be included in revegetation.

Production rates

Equipment	Small tractor and seed drill
Seeding width	10 feet
Operating speed	2.5 mph
Production rate	0.33 hr/ac
Travel length	4356 ft/ac

For 5 acres will require 2 hours to complete.

Cost rates

Tractor and seed drill	$50/hr @ 2	$100.00
Labor (2)	$27/hr @ 2	$108.00

Seed Mixture

Species	$/lb (PLS)	Drilled rate (lbs.)	Price/ac
Slender Wheatgrass	$1.25/lb	3	$3.75
Western Wheatgrass	$3.00/lb	2	$6.00
Fourwing Saltbrush	$8.00/lb	1	$8.00
Yellow Sweetclover	$0.60/lb	0.5	$0.30
Basin Wildrye	$5.60/lb	1	$5.60
Shadscale	$6.50/lb	2	$13.00
Small Burnett	$0.90/lb	2	$1.80
Thickspike Wheatgrass	$8.25/lb	0.5	$4.15
Prostrate Kochia	$17.50/lb	0.25	$4.40
Sainfoin	$1.40/lb	2	$2.80
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$56.30/ac

Total seed needs 5 acres at $56.30/ac $281.50

Removal of structures - Structure removal would consist mainly of removing process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 30 days to remove the facilities and bury the

foundations.

Total Estimated Cost Changes: Estimated cost changes are summarized in Table E-32.

Table E-32. Underground Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting			
Plan Preparation	3days at 8 hours	28/hr	$660.00
Permitting Total			$660.00
Underground Mining Activity:			
Capital Cost	Mine Development	$143,800	
	Leach Facility	$51,780	
	Equipment/ used and owned	$0	
			$195,500
Operating Cost			
	Labor	$252,000	
	Equipment	$198,000	
	Supplies	$200,000	
			$650,000
Underground Activity Total			$845,700

Reclamation:			
Earth Work			
Regrading			
Equipment	D6N Dozer	150/hr	$1,050
Labor:	operator	40/hr	$280
Revegetation			
Equipment			
	Small Tractor and seed drill	50/hr	$100
	Seed mixture	56.30/ac	$281.50
Labor:	2 laborers	27/hr	$108
Chemical Stabilization			
Estimated 100,000 tons,	Operating Cost	0.07/ton	$7,000
rinsing time 2 years	Materials Cost	0.05/ton	$5,000
	Labor: 2 people, 12 hours/day, 5 days/wks	27/hr	$6,400
Structural removal		60/day	$600
Equipment		165/day	$1,650
	2.5 ton truck for 10 days		
	Ho-lift equipment, 24ft boom-7.7mt lift		
Labor		27/hr	$6,480
	3 person crew for 10 days at 8 hours/day		
			$29,000
Total Cost of Underground Project			$875,400

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Alternative 2 is based on only the states' regulating mining on public lands. Determining costs for this alternative for all of the states involved in mining would not be practical for this exercise. Therefore, the following cost calculations would be based on the assumptions that the state program would be based on current State of Nevada program. A review of the state programs reveals that they are similar in posting bonds for reclamation and in surface water, ground water, and reclamation requirements. This analysis assumes that the state would require a Plan of Operations, reclamation, and monitoring for compliance.

Permitting and Environmental Costs:

Notice Preparation - The operator would have to submit a Notice-like document to the state but not to BLM. The operator would still prepare a Notice. There would be no cost saving to the operator under Alternative 2.

Reclamation Costs: It is assumed that the state would require reclamation of this type of

operation and no cost savings would result.

Total Estimated Cost Changes: Total cost savings for this Underground project under Alternative 2 are summarized in Table E-33.

Table E-33. Alternative 2 -- Changes in Costs for Underground Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$875,400
Total Change in Costs under Alternative 2	0
Total Project Cost under Alternative 2 (State Management)	$875,400
Percent Change in Costs from Alternative 1 to Alternative 2	0

Alternative 3: Proposed Action

General: Under the Proposed Action all mining operations would be required to submit Plans of Operations. Bonding and a potential validity exam would add cost to the underground mine model. The performance standards are basically being followed now. Therefore, in this model the soil stability design limit would not be approached because of reclamation. Any steep slopes could have some erosion control problems, but the model assumes that no additional cost of erosion control blankets would be needed above erosion and sediment control structures.

Permitting and Environmental Costs: Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation greatly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a board range. For the following costs several mining companies and consultant firms were contacted. These costs are averaged and shown in Table E-34.

Plans of Operations - The operation would be filed under a Plan of Operations. Under Alternative 3 all mining must submit a Plan of Operations. The operator would pay for the environmental analysis, which would include a wetlands study, steam restoration/reclamation plan, cultural survey, and a wildlife/fisheries field study.

Bonding - The Proposed Action would strengthen bonding to include the bonding of Plans at 100% of reclamation cost. Bonding would be used to reclaim sites if operators could not complete their reclamation obligations. The bond amount would change to cover the estimated cost to reclaim the operation. This model assumes that the operator is buying an annuity bond and paying insurance premiums at an estimated 5% of the bond amount.

Validity Exams - The Proposed Action would require BLM to conduct a validity exam before approving a Plan of Operations for an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under the Proposed Action.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-34.

Table E-34. Alternative 3 -- Change in Costs for Underground Project	
Total Project Cost under Alternative 1	$875,400
Change in Costs under Alt.3 due to Plan of Operations	2,500
Change in Costs under Alternative 3 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 3 due to Bonding	
5% for 10 yrs	$7,900
Total Change in Costs under Alternative 3	$120,400
Total Project Costs under Alternative 3	995,800
Percent Change in Costs from Alternative 1 to Alternative 3	10%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Validity Exam	10,000
Total Project Costs under Alternative 3	$973,300
Percent Change in Costs from Alternative 1 to Alternative 3	11%

Alternative 4: Maximum Protection

General: These type of standards and criteria under Alternative 4 would affect underground mining. Bonding, inspection and enforcement, replacing topsoil, and revegetation would directly affect underground mining.

The automatic stay for appeals under Alternative 4 would delay underground mining and result in the costs of lost time and the delay of potential future profits. The cost of delays are addressed in the following discount cash flow analysis.

Permitting and Environmental Costs:

Bonding - For underground mines most spills that would involve more costs for major environmental problems would be cyanide or petroleum spills. For this model any petroleum spill would be removed with the contaminated soils and trucked to an approved disposal site for treatment. This model assumes that the operator would build an oil treatment facility onsite to handle all spills from this operation. Because estimating the cost of each type of spill scenario

would be difficult, this analysis assumes that potential cyanide spills would add $50,000 more to the bond amount, placing the current estimated bond at $29,000.

The analysis again assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond. This insurance would cost the operator 5% of the bond amount for 5 years through project operation and reclamation.

Inspections - Under Alternative 4 operators would have to hire third-party contractors to monitor their operations. Contractors would have to monitor operations quarterly and could complete inspections and prepare reports in a 10-hour day. Environmental samples would be taken during operations. These samples would be used for acid/base accounting to monitor the acid rock drainage potential and for the 31-element analysis of water quality areas throughout the mine. This model assumes costs from the Nevada Division of Environmental Protection's Profile II analysis. These samples would be collected only to verify operator results.

Labor		
40 hrs @ $50/hr/year for 5 years (Davis and Bacon)		$10,000
Lab work		
Acid/Base accounting	$33.08/sample @ 20 samples	$700
Profile II	$354.24/sample @ 20 samples	$7,000
	Total cost	$17,700

Validity Exams - Under Alternative 4 validity exams would need to be conducted before BLM approves Plans of Operations. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. Operations would remove the topsoil as under other alternatives, but increased travel time to stockpile sites would decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. But the increased travel times would not be so great as to double the time needed to remove topsoil.

Under the other alternatives earth moving equipment would mix the soil and colluvium together as it moves them in one or two passes. Under Alternative 4 the material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. Efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the efficiency would be estimated at 0.75, about 1 hour more needed to complete the dirt work under the other alternatives. Under the main model the caterpillar would be able to place the topsoil on

the heap leach pads and waste rock dumps. However for this fine of work a scraper would be required over and above the cost of the caterpillar work.

Production rate			
	Equipment		615 Scraper
	Capacity		16 yd^3
	Average haul distance	1000 ft	
Cycle time			
	Cycles per hour		13.33 cycles/minute
Correction factors			
	Load factor		0.9
	Job efficiency		0.75
	Eff. Load capacity		10.8 yd^3
Hourly production			144 yd^3/hr
Cost Rates			
	615 scraper		$100/hr
	Operator		$ 40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Cubic Yards	Hours	Equipment Cost	Labor Cost
Waste Rock	1	200	1.4	$140.00	$56.00
Ancillary Facilities	4	1,500	10	$1,000.00	$400.00
Cost of Recontouring				$1,140.00	$456.00

Revegetation - Under Alternative 4 only native species would be used in revegetation. The underground model outlines the seed mixture that would be used. All other aspects of seeding the project would remain the same as under Alternative 1.

Seed Mixture (Mining Cost Service)

Species	Amount
Sanberg Bluegrass	20%
Indian Rice Grass	20%
Blue Grama	20%
Thickspike Wheatgrass	10%
Sand Dropseed	10%
Blue Flax	10%
Purple Coneflower	5%
Prairie Coneflower	5%
Scarlet Globemallow	5%
Utah Sweet Vetch	5%

Total seed needs 5 acres at ($9.50/lb @ 10lbs/ac) $95/ac $475

Soil Stability - To meet the stability standard for Alternative 4, other measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes, the following acreage would need erosion control blankets: waste rock 1 acres and leach pads 3 acres, for a total of 4 acres. Erosion control blankets cost $0.45/$yd^2$. For 4 acres @ 4,840 yd^2/acre, for a total of19,360 yd^2 to be covered, the total cost would amount to $8,700.

Wetlands - Alternative 4 would require that any wetlands would have to be restored within 10 years after a mine closes and is reclaimed. If this goal cannot be reached, then 1.5 times the amount of disturbed or lost land would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit mines do remove wetlands in placing the pit or the waste rock dumps. This model assumes that 1 acre of wetlands would be lost to waste rock dumps.

The cost of offsite mitigation is estimated at the same cost as stream restoration under Alternative 4 of the placer mining model. For Alternative 4, the model assumes $2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for wetlands in properly functioning conditions. This analysis assumes stream restoration cost to be $2,500/acre for 1 acres for a total cost of $2,500.

Total Estimated Cost Changes: If the operation is not within a withdrawn area, the project would incur the costs shown in Table E-35.

Table E-35. Alternative 4 -- Change in Costs for an Underground Project	
Total Project Cost under Alternative 1:	$875,400
Change in Costs under Alternative 4 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 4 Due To:	
Bond Cost	19,700
Third Party Monitoring	17,700
Applying Top Soil	1,600
Revegetation Cost	190
Soil Stabilization	8,700
Validity Exam	10,000
Total Change in Costs under Alternative 4:	137,890
Total Project Costs under Alternative 4:	1,013,290
Percent Change in Costs from Alternative 1 to Alternative 4:	16%

Alternative 5

Same as Alternative 3 except no validity exam would be required before an operation could begin.

Total Estimated Cost Changes: Estimated cost changes are summarized in the Table E-36.

Table E-36. Alternative 5 -- Change in Costs for Underground Project	
Total Project Cost under Alternative 1	$875,400
Change in Costs under Alternative 5 due to Plan of Operations	$2,500
Change in Costs under Alternative 5 due to EA	$80,000
Includes Wetlands study	5,000
Restoration/reclamation plan	5,000
Wildlife/fisheries studies	10,000
Cultural survey	10,000
Change in Costs under Alternative 5 due to Bonding 5% for 10 yrs	$7,900
Total Change in Costs under Alternative 5	$120,400
Total Project Costs under Alternative 5	995,800

Percent Change in Costs from Alternative 1 to Alternative 5	10%

Open Pit Model

The open pit model is for a medium-sized gold mine of a larger mining company.

Resource size:	7,000,000 tons
Production rate:	4,000 tons per day
mine life:	6 years mining and 4 years reclamation
Average grade:	0.053 oz. per ton @ $300/oz. Strip ratio: 2:1
Pit dimensions:	1000 ft x 900 ft x 130 ft deep
Equipment used:	Rotary drill (GD-25C), hydraulic crawler drill (HDR12E), air compressor, four loaders (988-B), four 50-ton rear-dump trucks (733), dozer (D-8) dozer (TD-25), grader, 4,000 gal water truck , two maintenance trucks, and two pickups
Fuel:	10,000 gallon portable tank gasoline, 50,000 gallon portable tanks for diesel and propane
Processing:	The operation uses conventual heap leach technology. Chemicals used for this process are on the site. A construction material dump is onsite, and a bioremediation facility is onsite to process minor petroleum spills.
Crew:	60 workers
Housing:	Nearby towns
Permitting:	EIS completed in 18 months, high public interest, baseline studies required to complete EIS, extensive joint federal/state coordination, cultural field studies
Reclamation:	Postmining recontouring and revegetation, stream restoration, water stabilization and recharge, chemical stabilization, wildlife reclamation projects

Note: Waste rock dumps were built to the grade standards outlined for each alternative, i.e. Alternative 3 states a 2:1 slope or a stable system, whereas Alternative 4 states a 3:1 slope. Roads would be built to meet standards for the alternative. The pit would have a small pit lake. Ground water would flow into the pit lake and evaporate. The pit lake would not overflow seasonally. Material at the site has been tested and shows no acid generation potential. The waste rock would have a 30% swell factor.

The model was derived from *Mining Cost Services* (Western Mine Engineering, Inc. 1997b), CM Appendix D4. The difference between the cost index for the original model development and the cost index for this model development was slight. Therefore, adjustments did not need to be made.

Permitting and Environmental Cost:

Plan of Operations - Permitting and environmental costs are hard to determine in a generalized way. The costs of permit authorizations and environmental documentation highly vary with site-specific conditions. Depending on the ore body and its location and other local environmental conditions, the cost can cover a broad range. The operator would pay for the EIS, which would include hydrological and hydrogeology reports, acid rock drainage analysis, cultural surveys, soil and vegetation field surveys, fish and wildlife field surveys, Endangered Species Act Section 7 consultation, and pit water quality analysis. The costs developed for this model and alternatives were derived from several mining companies and consultant firms.

Bonding - The operation would require a Plan of Operations. The bond would be for 100% cost of the reclamation. Closing the heap leach pads and the rest of the mine would cost $2,000/acre. This model assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond at an estimated 5% of the bond amount per year. The model further assumes that the operator has a good credit rating and has the assets to back the bond.

Reclamation Cost:

Earthwork - The earthwork would consist of recontouring the waste rock dump, leach pads, roads, and ancillary facilities and covering all these features with topsoil. The dump had been built to easily conform to the slope requirement. The amount of material moved and the amount of time needed to move the material is estimated below for analysis purposes.

Regrading:

Production rate		
	Equipment	D9N and U Blade
	Average Dozing distance	300 ft
	Final slope configurations	2.5H:10V(40%)
	Production	500 yd^3/hr
Correction factors		
	Operator average	0.75
	Material - loose stockpile	1.20
	Type dozing - slot to side by side	1.20
	Job efficiency	0.83
	Weight correction	0.83
Hourly Production rate		372 cu. yd./hr
Cost Rates		
	Bulldozing (D9N)	$155/hr
	Operator	$40/hr

Using the above data, the following table estimates equipment and labor costs for regrading.

	Acres	Quantity (yd^3)	Time (hours)	Equipment Cost	Labor Cost
Waste Rock	120	2,800,000	7,526	$1,166,530	$301,040
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total Cost for Regrading				$1,416,235	$365,480

*Assumption that ripping production is the same as blading work.

Applying Top Soil:

The growth medium would be applied to an average thickness of 6 inches, using a scraper.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.83
	Eff. Load capacity	14.4 yd^3
Hourly production		159.4 yd
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs for applying top soil.

	Acres	Quantity (yd^3)	Hours	Equipment Cost	Labor Cost
Waste Rock	120	290,400	1,821	$182,100	$72,840
Roads	200	484,000	3,036	303,600	121,440
Ancillary Facilities	150	363,000	2,277	227,700	91,080
Leach Pads	125	302,500	1,897	189,700	75,880
Total Cost of Applying Top Soil				$903,100	$361,240

Revegetation - Revegetation would consist of scarifying and preparing the ground for seeding. Drill seeding would be applied. Aspects of wildlife enhancement and wetlands reclamation would

be included in revegetation.

Production rates

Equipment	14-G Grader with scarifier
Scarifying width	10 feet
Operating speed	1.0 mph
Production rate	1.0 hr/ac
Equipment	Small tractor and seed drill
Seeding width	10 feet
Operating speed	2.5 mph
Production rate	0.33hr/ac
Travel length	4356.0 ft/ac

Cost rates

Tractor and seed drill	$50/hr
14-G Grader	$80/hr
Operator - grader	$40/hr
Labor (2)	$27/ac

Seed Mixture

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3.0 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2.0 lbs	$6.00/ac
Fourwing Saltbrush	$8.00/lb	1.0 lb	$8.00/ac
Yellow Sweetclover	$0.60/lb	0.5 lb	$0.30/ac
Basin Wildrye	$5.60/lb	1.0 lb	$5.60/ac
Shadscale	$6.50/lb	2.0 lbs	$13.00/ac
Small Burnett	$0.90/lb	2.0 lbs	$1.80/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Prostrate Kochia	$17.50/lb	0.25 lb	$4.40/ac
Sainfoin	$1.40/lb	2.0 lbs	$2.80/ac
Sandberg Bluegrass	$26.00/lb	0.25 lbs	$13.00/ac
		Total	$56.30/ac

Using the above data, the following table estimates equipment and labor costs for reseeding.

	Acres	Hours	Equipment Cost ($)	Labor Cost ($)
Waste Rock	120	120 (grader) 39 (drill)	$9,600 1,950 6,756	$ 4,800 2,106
Roads	200	200 66	16,000 3,300 11,260	8,000 3,564
Ancillary Facilities	150	150 50	12,000 2,500 8,445	6,000 2,700
Leach pads	125	125 41	10,000 2,050 7,038	5,000 2,214
Cost of Reseeding			$90,899	$34,384

Chemical Stabilization - Chemical stabilization would involve neutralizing the cyanide content of the heap leach pads and processing facilities. Operating costs include any capital items such as pumps, piping, maintenance, and power. Costs for materials include the use of chemicals. The following figures were derived from submitted bond calculations and actual numbers from operations that have met closure. This reclamation involves heap flushing with water only. No other chemicals are added.

Removal of Structures - Structure removal would consist mainly of removing powerlines, process buildings, office trailers, maintenance shops, and high-density polyethylene pipelines used by the project. The model assumes that five workers would take 80 days to remove the facilities and bury the foundations.

Total Open Pit Costs:

Table E-37 lists total costs for the open pit mining model.

Table E-37. Open Pit Model Costs

Description of Activity	Cost Item	Unit Cost	Total Cost
Permitting Plan Preparation	Environmental and Engineering Departments Several Weeks		$10,000
EIS preparation			600,000
	Includes: Wetlands Study	$5,000	
	Water-Related Reports	$200,000	
	Restoration and Reclamation	$5,000	
	Wildlife/Fisheries Studies	$10,000	
	Vegetation/soil Report	$5,000	
	Cultural Survey	$20,000	
Bond Cost	Estimated Bond $2,891,842	5% for 10yrs	1,445,921
Permitting Total			2,055,921
Reclamation			
Capital Cost			14,000,000
Operating Cost - Labor			10,368,000
Operating Cost - Equipment			1,382,400
Exploration Activity Total			$25,750,400

Reclamation:			
Earth Work			
Regrading			
Equipment*:	D9N Dozer	155/hr	1,416,235
Labor*:	operator	40/hr	365,480
Applying top soil			
Equipment*:	615 Scraper	100/hr	903,100
Labor*:	operator	40/hr	361,240
Revegetation			
Equipment*	14-G Grader	80/hr	
	Small Tractor and seed drill	50/hr	90,899
	Seed mixture	56.30/ac	
Labor*:	Grader operator	40/hr	34,384
Total earth work and revegetation	2 laborers	27/hr	*3,171,338*
Chemical Stabilization			
Estimated 7,000,000 tons,	Operating Cost	0.07/ton	490,000
	Materials Cost	0.05/ton	350,000
rinsing time 3 years	Labor: 2 people, 12 hours/day, 5 days/wks	27/hr	505,440
Total Chem. Stabilization			*1,345,440*
Structural removal		60/day	
Equipment	2.5 ton truck for 80 days	165/day	
	Ho-lift equipment, 24ft boom-7.7mt lift	155/hr	20,480
	D9N Dozer for 2 days		
		27/hr	8,100
Labor	5 person crew for 80 days at 8 hours/day		*106,880*
Total Structural removal			4,623,558
Reclamation Total			
Total Cost of Open Pit Project			$32,429,879

*See estimated time to complete task in information above.

Alternative 1: No Action

Costs would not change under Alternative 1 because the regulations would not change.

Alternative 2: State Management

General: Determining costs for Alternative 2 for all of the states in the EIS study area would not be practical for this exercise. Therefore, the following cost calculations assume that the state programs are based on current BLM regulations. A review of state programs reveals that they are similar in requirements for posting reclamation bonds, for surface and ground water, and for reclamation.

This analysis assumes that the state would require a submission of a Plan of Operations. The state would still require reclamation, the posting of bond, and monitoring for compliance, but not environmental review for such values as cultural, cave, and wildlife resources.

Permitting and Environmental Costs:

Plan of Operations - The operator would have to submit a Plan of Operations to the state but not to BLM. The project would not undergo environmental review, and the operator would not pay for an environmental impact statement.

Reclamation Cost: This analysis assumes that the state requires reclamation and that the company would have to reclaim any disturbance resulting from its operation. Reflecting general state programs, the purpose of reclamation would be only to stabilize soil and slopes. Therefore, this analysis assumes that the state would require only grasses for soil stability and that reclamation would not require restoring wildlife and fisheries habitat.

Seed Mixture

Species	$/lb (PLS)	Drilled rate	Price/ac
Slender Wheatgrass	$1.25/lb	3 lbs	$3.75/ac
Western Wheatgrass	$3.00/lb	2 lbs	$6.00/ac
Basin Wildrye	$5.60/lb	1 lb	$5.60/ac
Thickspike Wheatgrass	$8.25/lb	0.5 lb	$4.15/ac
Sandberg Bluegrass	$26.00/lb	0.25	$13.00/ac
		Total	$32.50/ac

The following cost calculations show the cost for the seed mixture under Alternative 2.

Waste Rock	120 acres	$3,900.00
Roads	200 acres	$6,500.00
Ancillary Facilities	150 acres	$4,875.00
Leach pads	125 acres	$4,062.50
	Total	$19,337.50

Total Estimated Cost Changes: Total cost savings for this open pit project under Alternative 2 are summarized in Table E-38.

Table E-38. Alternative 2 -- Changes in Costs for a Open Pit Project	
Total Project Cost under Alternative 1 (Existing Regulations)	$32,429,879
Change in Costs under Alternative 2 due to Elimination of Environmental Review Change in Seed Cost Total Change in Costs under Alternative 2	 (600,000) (14,161) (614,161)
Total Project Cost under Alternative 2 (State Management)	31,815,718
Percent Change in Costs from Alternative 1 to Alternative 2	-2%

Alternative 3: Proposed Action

General: Impacts to the industry under the Proposed Action would be slight because BLM and industry are generally following these procedures in authorizing operations and accepting final closure and reclamation.Under the Proposed Action any operation within a mineral withdrawal area would have the addedl cost in time and money of completing a validity exam of the claims. The added cost to industry would involve stabilizing the soil. Land use plans are assumed to conform to mineral activity.

Reclamation would not approach the soil stability design limit. Any steep slopes could have some erosion problems, but this model assumes that no additional cost of erosion control blankets would be incurred above erosion and sediment control structures.

The operation would have a small pit lake. This model assumes that ground water flows into the pit and that for environmental and economic reasons 25% of the pit would be backfilled and the pit lake would be covered. To offset the loss of habitat from the open pit, a 200-acre vegetation conversion would be completed with water developments.

Permitting and Environmental Costs:

Bonding - The Proposed Action would strengthen bonding to include bonding of Notice-level operations at 100% of reclamation costs. Bonding would be used for reclaiming sites if operators could not meet their reclamation obligations.

This model assumes that the operator is purchasing an annuity bond and paying an insurance premium that would cost 2% of the bond amount, estimated at $4,623,558. The bond would be assessed on the estimated reclamation cost and for 10 years through mining and reclamation.

Validity Exams - This provision requires that a validity exam be conducted before BLM approves a Plan of Operations within an area withdrawn from the mining laws. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Backfilling - In placer and strip mines after processing, materials mined are normally placed in the mine opening at only minimal cost. Well-blasted rock, however, swells about 50% in volume, and not all material would be returned to the pit. The rest of the materials would have to be reshaped in place and reclaimed. For this operation the model assumes that only 25% of the material would need to be replaced into the pit. The pit would be only partially filled for economic or environmental reasons.

A study by BLM's Nevada State Office (BLM 1998d) on the economics of pit backfilling found that the cost of returning material to a pit ranged from $0.68 to $1/ton. This model uses the average of the figures as $0.75/ton.

The model assumes 7 millions tons of reserves and 14 million tons of overburden. Of this overburden only 25% or 3.5 million tons would be returned to the pit. The remaining waste rock

would be placed in a waste rock dump built to conform to the 3:1 slope standard. The amount of material to be moved to complete the final contours would be 25% less than that moved under Alternative 1. Therefore, 10.5 million tons of material would be placed in waste rock dumps. The current model shows that 2.8 million tons of material would have to be recontoured. With 25% of this material removed and placed in the pit, only 2.1 million tons of material would need to be moved to recontour the waste rock dumps. The hourly production rate is 372 yd^3/hr.

Cost Rates
Bulldozing (D9N) = $155/hr
Operator = $40/hr

Using the above data, the following table estimates equipment and labor costs for recontouring.

	Acres	Quantity (yd^3)	Time (hours)	Equipment Cost	Labor Cost
Waste Rock	120	2,100,000	5645	$874,975	$225,800
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total for Recontouring				$1,124,700	$290,200

*Assumption that ripping production is the same as blading work.

Total cost of recontouring work for Alternative 3 = $1,414,920

The cost under Alternative 1 would amount to $1,781,715, and the cost under Alternative 3 would be $1,414,920. Alternative 3 would thus save $366,795 over Alternative 1 by recontouring less material and returning more to the pit.

$2,625,000 for backfilling minus the cost saving of recontouring—$366,795

For a total cost of backfilling operation at 25% = $2,258,205.

Total Estimated Cost Changes: Estimated cost changes for an open pit mine are summarized in Table E-39.

Table E-39. Alternative 3 -- Change in Costs for an Open Pit Project	
Total Project Cost under Alternative 1	$31,562,426
Change in Costs under Alternative 3 due to Bonding Reclamation Total Change in Costs under Alternative 3	 364,700 2,258,200
Total Project Costs under Alternative 3	34,185,326
Percent Change in Costs from Alternative 1 to Alternative 3	8%
Change in Costs Assuming Validity Exam is Conducted	
Change in Costs under Alternative 3 due to Bonding Reclamation Validity Exam	 364,700 2,258,200 10,000
Total Project Costs under Alternative 3	34,195,326
Percent Change in Costs from Alternative 1 to Alternative 3	8%

Alternative 4: Maximum Protection

Alternative 4 would directly affect open pit mining through requirements for bonding, inspection, and enforcement, backfilling, stabilizing soil, handling topsoil, and revegetation. The need for validity exams, bonding criteria, and fish and wildlife habitat and wetland protection could also affect open pit operations. Waste rock and road designs would be incorporated into the mine design and would not normally have a major economic cost. This model assumes no additional cost for road and slope stability design standards under Alternative 4.

The acid rock drainage testing would be completed during the environmental review. This model assumes that a kinetic test would be included in the review. No other tests would be run unless the potential for acid generation changes from the rock types tested.

For ease of analysis, water from the mine is assumed not to require long-term treatment. The cost of the different types of water treatment vary greatly. If water is treated, it would be difficult to determine the duration of the treatment.

Permitting and Environmental Costs:

Bonding - Bonding under Alternative 4 would be as outlined for Alternative 3 but would include more money to cover potential unplanned environmental events, which could involve both processing chemicals and chemicals used in labs and for equipment maintenance (fuels and lubricants).

For open pit mines most spills that would involve more costs for major environmental problems would be petroleum and cyanide spills. For this model any petroleum spill would be removed with the contaminated soils and trucked to an approved disposal site for treatment. This model assumes that the operator would build an oil treatment facility onsite to handle all spills from this operation. Because estimating the cost of each type of spill scenario would be difficult, this analysis assumes for cyanide that $250,000 more would be assigned to the bond, placing the current estimated bond at $4,983,658.

The analysis again assumes that the operator is purchasing an annuity bond from an agency and would pay an insurance premium for the bond. This insurance would cost the operator 5% of the bond amount for 10 years through project operation and reclamation.

Inspections - Under Alternative 4 operators would have to hire third-party contractors to monitor their operations. Contractors would have to monitor operations quarterly and could complete inspections and prepare reports in a 10-hour day. Environmental samples would be taken during operations. These samples would be used for acid/base accounting to monitor the acid rock drainage potential and for the 31-element analysis of water quality areas throughout the mine. This model assumes costs from the Nevada Division of Environmental Protection's Profile II analysis. These samples would be collected only to verify operator results.

Labor		
40 hrs @ $50/hr/year for 10 years (Davis and Bacon)		$20,000
Lab work		
Acid/Base accounting	$33.08/sample @ 40 samples	$1,323
Profile II	$354.24/sample @ 40 samples	$14,170
	Total cost	$35,493

Validity Exams - Under Alternative 4 validity exams would need to be conducted before BLM approves Plans of Operations. These costs would remain the same as outlined for exploration under Alternative 3.

Reclamation Costs:

Backfilling - In placer and strip mines, materials mined are normally placed in the mine opening after processing, and only minimal cost is involved. Well-blasted rock would swell about 50% in volume. The material would not go back completely into the pit. The rest must be reshaped in place and reclaimed.

A BLM Nevada State Office (BLM 1998d) study on the economics of pit backfilling found that the cost of returning material to a pit ranged from $0.68 to $1/ton. This model uses the average of the figures as $0.75/ton. The model assumes 7 millions tons of reserves and 14 million tons of overburden and that 75% of the material would be required to fill up the pit and 25% of the material would be placed in a waste rock dump. A total of 10.5 million tons of material would be

placed in the pit and would cost $7,875,000.

The remaining waste rock would be placed in a waste rock dump. The dump would be built to conform to the 3:1 slope standard. The amount of material to be moved to complete the final contours—175,000 tons—would be 25% less than what would be moved under the Alternative 1 scenario. This analysis assumes that only 50 acres are now covered in waste rock dumps.

	Hourly Production rate =	372 yd^3/hr
Cost Rates		
	Bulldozing (D9N) =	$155/hr
	Operator =	$40/hr

Using the above data, the following table estimates equipment and labor costs for backfilling.

	Acres	Quantity (yd^3)	Hours	Equipment Cost	Labor Cost
Waste Rock	50	175,000	470	$72,850	$18,800
Roads*	200	250,000	672	104,160	26,880
Ancillary Facilities	150	150,000	403	62,465	16,120
Leach Pads	125	200,000	536	83,080	21,440
Total Cost To Recontour				$322,600	$83,200

*Assumption that ripping production is the same as blading work.

The cost of recontouring under Alternative 1 would amount to $1,781,715, and the cost of recontouring under Alternative 4 would amount to $405,800. Alternative 4 would save $1,375,920 in recontouring costs because less material would be recontoured and more would be returned to the pit.

$7,875,000 for backfilling minus the cost saving of recontouring	$1,375,920
For a total cost of backfilling operation	$6,499,080.

Topsoil - Under Alternative 4 the topsoil would be removed by soil horizons. Operations would remove the topsoil as under other alternatives, but increased travel time to stockpile sites would decrease the efficiency of the earth moving equipment by not allowing the blade to take as deep a cut as possible. But the increased travel times would not be so great as to double the time needed to remove topsoil.

Under the other alternatives earth moving equipment would mix the soil and colluvium together as it moves them in one or two passes. Under Alternative 4 the material would be removed to different locations on either side of the road or drill pads. The travel distance would remain the same, but the efficiencies of the equipment would decrease. Efficiencies were estimated from the *Caterpillar Performance Handbook* (Caterpillar Inc. 1996) as 0.83. For Alternative 4 the

efficiency would be estimated at 0.75, about 1 hour more needed to complete the dirt work under the other alternatives.

Production rate		
	Equipment	615 Scraper
	Capacity	16 yd^3
	Average haul distance	1000 ft
Cycle time		
	Cycles per hour	13.33 cycles per minute
Correction factors		
	Load factor	0.9
	Job efficiency	0.75
	Eff. Load capacity	10.8 yd^3
Hourly production		144 yd^3/hr
Cost Rates		
	615 scraper	$100/hr
	Operator	$ 40/hr

Using the above data, the following table estimates equipment and labor costs of earthwork.

	Acres	Quantity (yd^3)	Hours	Equipment Cost	Labor Cost
Waste Rock	50	90,750	630	$63,000	$25,200
Roads	200	484,000	3,361	336,100	134,440
Ancillary Facilities	150	363,000	2,520	252,000	100,800
Leach Pads	125	302,500	2,100	210,000	84,000
Total Cost for Earthwork				$861,100	$344,500

Revegetation - Under Alternative 4 only native species would be used in revegetation. The open pit model outlines the seed mixture that would be used. All other aspects of seeding the exploration project would remain the same as under Alternative 1.

Seed Mixture (Mining Cost Service)

Species	Amount
Sanberg Bluegrass	20%
Indian Rice Grass	20%
Blue Grama	20%
Thickspike Wheatgrass	10%
Sand Dropseed	10%
Blue Flax	10%
Purple Coneflower	5%
Prairie Coneflower	5%
Scarlet Globemallow	5%
Utah Sweet Vetch	5%
Total $9.50/lb @ 10lbs/ac	$95/ac

Using the above data, the following table estimates equipment and labor costs of revegetation.

	Acres	Hours	Equipment Cost	Labor Cost
Waste Rock	50	50 grader 25 drill	$4,000 1,250 4,750	$2,000 1,350
Roads	200	200 66	16,000 3,300 19,000	8,000 3,564
Ancillary Facilities	150	150 50	12,000 2,500 14,250	6,000 2,700
Leach pads	125	125 41	10,000 2,050 11,875	5,000 2,214
Total Revegetation Cost			$100,975	$30,828

Soil Stability - To meet the stability standard for Alternative 4 other measures would need to be implemented. Any steep slopes could have some erosion control problems, but the added cost of erosion control blankets would be needed above standard erosion and sediment control structures. For analysis purposes the following acreage would need erosion control blankets: waste rock 20 acres, roads 20 acres, leach pads 20 acres, for a total of 80 acres. Erosion control blankets cost \$0.45/yd^2. For 80 acres @ 4840 yd^2/acre, for a total of 287,200 yd^2 to be covered, the total cost would amount to \$174,240.

Fish and Wildlife - Under Alternative 4 within 10 years some areas of the mine might not return to the fish and wildlife habitat of premining status. Some offsite mitigation would be required to offset this loss. The common type of mitigation is vegetation manipulation. These types of actions take marginal habitat and change the vegetation to a more suitable habitat. Conversations with BLM biologists reveal that the average cost of such manipulation amounts to \$1,000/acre. This analysis assumes that the pit and some of the haul roads would not be reclaimed within the 10 years and that 100 acres of vegetation would be manipulated at a cost of \$100,000.

Wetlands - Alternative 4 would require that any wetlands would have to be restored within 10 years after a mine closes and is reclaimed. If this goal cannot be reached, then 1.5 times the amount of disturbed or lost land would need to be replaced. Reclamation is usually successful in restoring wetlands to proper functioning condition within 10 years. But open pit mines do remove wetlands in placing the pit or the waste rock dumps. This model assumes that 10 acres of wetlands would be lost to waste rock dumps.

The cost of offsite mitigation is estimated at the same cost as stream restoration under Alternative 4 of the placer mining model. For Alternative 4 the model assumes \$2,500/acre (INTER-FLUVE, Inc. 1991), which is needed to meet the 10-year requirement for wetlands in properly functioning conditions. This analysis assumes stream restoration cost to be \$2,500/acre for 15 acres for a total cost of \$37,500.

Total Estimated Cost Changes: If the exploration operation is not within an area withdrawn for minerals, the project would incur the costs shown in Table E-40.

Table E-40. Alternative 4 -- Change in Costs for an Open Pit Project	
Total Project Cost under Alternative 4:	$31,562,426
Change in Costs under Alternative 4 Due To:	
Bond Cost	418,400
Third Party Monitoring	35,500
Backfill Cost Minus Earthwork Cost	6,499,080
Applying Top Soil	(58,740)
Revegetation Cost	6,520
Soil Stabilization	174,240
Habitat Restoration	100,000
Validity Exam	10,000
Wetland Restoration	37,500
Total Change in Costs under Alternative 4:	7,215,980
Total Project Costs under Alternative 4:	38,778,400
Percent Change in Costs from Alternative 1 to Alternative 4:	23%

Alternative 5

Same as Alternative 3 except no validity exam would be required before operation could begin. There would be no added reclamation cost with backfilling.

Total Estimated Cost Changes: Estimated cost changes for an open pit mine are summarized in Table E-41.

Table E-41. Alternative 5 -- Change in Costs for an Open Pit Project	
Total Project Cost under Alternative 1	$31,562,426
Change in Costs under Alternative 5 due to Bonding	364,700
Total Project Costs under Alternative 5	31,927,126
Percent Change in Costs from Alternative 1 to Alternative 5	1%

Cost Model Summary

Table E-42 outlines the change in cost and the percentage of change in cost between Alternative 1 and the others alternatives analyzed in this EIS.

Table E-42. Total Cost of Mine Models

	Alternative 1	Alternative 2	% Change	Alternative 3	% Change	Alternative 4	% Change	Alternative 5	% Change
Small Exploration	20,320	19,870	-2	20,820	+2	61,790	+203	28,820	+2
				41,820	+105				
Exploration	207,337	206,225	-1	208,697	0	319,514	+54	208,697	0
				301,197	+45				
Small Placer	319,320	311,400	-3	428,100	+34	483,320	+51	428,100	+34
				438,100	+37				
Placer	1,154,250	1,058,410	-3	1,238,050	+7	1,305,130	+13	1,238,00	+7
				1,248,050	+5				
Strip Mining/ Industrial Mineral	2,909,200	2,826,800	-2	3,005,200	+3	3,335,200	+15	3,005,200	+3
				3,035,200	+4				
Underground	875,400	875,400	0	963,300	+10	1,013,290	+16	963,300	+10
				973,300	+11				
Open Pit	31,562,462	30,948,300	-2	34,185,300	+8	38,778,400	+22	31,927,126	+1
				34,195,300	+8				

Discounted Cash Flow

In response to public comments, a summary of the discounted cash flow analysis developed for the Final Small Business and Regulatory Flexibility Act Analysis (USDI 2000) has been incorporated into this EIS. The modeled operations were all projected to employ 500 or fewer people. But the placer and exploration operations would be more likely to typify a mining firm with the potential to be faced with relatively greater impacts due to the regulation.

The cost models suggest that different types of operations would be expected to face different magnitudes of cost and profit changes. The impacts can further be categorized by (1) those that affect Existing Notices and Plans and (2) those that may affect new Notices and Plans.

New Notices and Plans

Placer Models: The analysis modeled the annual costs and revenues of a small and medium-size placer mine. This approach (in contrast to an approach that modeled streams of costs and revenues over the life of a mine) was chosen because placer operations typically make decisions to operate on an annual basis in response to current commodity market conditions and other factors. The small placer mine was assumed to be a Notice-level mine that would convert to a Plan of Operations under the new regulations. The medium size placer model was assumed to be a Plan-level operation under the existing and proposed regulations. This model would not incur any costs of "converting" to a Plan, but it would incur added reclamation and bonding costs. Both models assumed that operators did not incur labor or capital costs and that annual bonding costs amounted to 5% of total reclamation costs. It was also assumed that under the new regulations added reclamation requirements might be imposed on these operations. These requirements were modeled as an increase in reclamation costs from $10 to $17 per stream foot.

Because placer mining activities are very sensitive to gold prices and ore grades BLM has modeled a variety of different gold prices and ore grades. The results of the models for the medium and small placer mine show that these mines could face annual operating cost increases of up to 11% and 13%, respectively. Reductions in annual profits for the medium and small mines could range from 3% to 11% and 4% to 20%, respectively. The low end of the ranges represents higher ore grades and a gold price of $350 per ounce; the high end represents lower grade ore and a gold price of $250 per ounce.

Permitting costs were not included in the estimates of annual cost and profit changes. Permit costs are a fixed cost that would be incurred before mining. These costs can be highly variable depending on the nature, scope, and location of the activities. Permit costs could range from under $1,000 up to $100,000. Data is not available on the distribution of these costs across placer mining operations. In some locations, BLM is likely to bear a portion of these costs. If BLM were to bear all of these costs, the cost changes faced by operators would include only those for annual bonding and reclamation.

The magnitude of permitting costs will obviously affect both costs and profits. BLM recognizes that increases in upfront fixed permitting costs could result in some operators being precluded from mining. The regulations–not including permit costs–were estimated to reduce annual profits

by about $4,000 and $6,000 for the small and medium placer models, respectively. Under the low gold price-low ore grade scenario ($250 per ounce, 0.014 ounces/ton) annual profits were estimated to be about $20,000. These profits suggest that, given the model's assumptions, both the small and medium placer mines could absorb at least some increases in permitting costs. The extent to which they are able to do this depends on the magnitude of the permitting costs, ore grades, available capital, commodity prices, and management ability.

Open pit model: A medium-size open pit gold heap leach mine was modeled. This mine would submit a Plan under the existing and proposed regulations. Baseline permit costs were assumed to range from $200,000 - $1 million. With the regulation, permit costs were modeled as increasing from 0% to 50%. Under the regulation, backfilling was modeled to range from 0% to 25%. The "with regulation" situation was also modeled with and without a 1-year delay in mining. The cost of this delay is modeled as the mine owner's cost of capital multiplied by the capital investment. Bonding costs under the existing regulations were assumed to amount to 5% of the reclamation costs. Under the proposed regulations it was assumed that these costs would increase to 6%, representing a weighted average to account for the fact that corporate guarantees will no longer be allowed.

The model results are sensitive to the timing of the cost and revenue flows, as well as to the absolute magnitudes of permitting costs, the price of gold, and the percent of pit backfilling required. For example, delays, to the extent that they could be attributed directly to the regulatory changes, result in increased costs to mine owners as well as deferring variable mine operating costs and revenues. But the extent to which the regulation will result in delays relative to the existing baseline is not clear.

Across the "delay" and "no delay" models, the estimated cost changes range from 0% to 2%. The upper end of the range represents a 50% increase in baseline permit costs of $1 million and 25% backfilling. The lower end of the range represents no backfilling and changes in permit costs that range from 0% to 50%. In some cases costs appear to decline under the proposed regulations because including a delay in mining in the model also implies delaying variable operating costs. The delay in the occurrence of costs results in smaller costs on a present value basis.

Estimated changes in profits depend on assumptions about gold prices. At a price of $350 per ounce, profits are estimated to decline from about 0% to11%. At a gold price of $300 per ounce, profits decline by 1.5% to12%. At a price of $250 per ounce they decline by 2% to 13%. The high end of each range is associated with baseline permit costs increasing from $1 million to $1.5 million and 25% backfilling.

Industrial/Strip: The industrial/strip mine was modeled as a gypsum mine operating under a Plan under both the existing and proposed regulations. The effect of the new regulations would be to potentially increase permitting costs and to require added bonding costs. The model included baseline permit costs ranging from $40,000 to $150,000, with up to a 50% increase in these costs. Bonding costs were assumed to represent 5% of reclamation costs. Costs were estimated to increase from 5% to 9%. The lower end of the range represents an increase in baseline permit costs of $40,000; the upper end of the range represents a 50% increase in baseline permit costs of $150,000. Profits were estimated to decline by 8% to15% at a price of $7 per ton. The declines

ranged from 6% to 11% at $8 per ton. Annual bonding costs and one-time permitting costs are the main components of the cost increases in this model. The requirement to bond at actual reclamation costs increases annual bonding costs from an estimated $6,500 to $16,000. If annual bonding costs were about $10,000, costs are estimated to increase by 5.5% and profits decline by 9% (assuming baseline permit costs of $100,000 increase by 50%).

Underground: A small notice-level underground mine was modeled under the assumption that this mine would operate for 5 years and be reclaimed for 2 years. The major change under the proposed regulations would be increased permitting, reclamation, and bonding costs. The operation would be required to file a Plan under the proposed regulations. Baseline permit costs were assumed to be $10,000, and these costs were modeled to increase to either $50,000 or $100,000. The model incorporated a 2-year delay in mining (relative to the base case) as well as a "no delay" scenario.

Results from the model reveal that the reduction in profits could range from 2% to 62%, depending on changes to permitting costs, the price of gold, and the extent to which "delays" were attributed to the regulation. If there are no delays (relative to the existing baseline) the model results indicate profit reductions by 2.3% to 5% if the price of gold is $350 per ounce; by 4.0% to 8.4% if the price of gold is $300 per ounce; and by17% to 36% if the price of gold is $250 per ounce. The low end of each range is associated with baseline permitting costs increasing from $10,000 to $50,000; the upper end of each range is associated with permitting costs increasing from $10,000 to $100,000.

Exploration: Two exploration models were developed: a small and medium-sized exploration operation. The small exploration model assumed a Notice-level operation that would be completed within a month. Baseline permit costs were assumed to be $200. This operation was assumed to remain at a Notice level under the proposed regulations. The major change would be increased reclamation and bonding costs. This project was modeled as disturbing 1 to 2 acres, and reclamation costs were estimated at $750. The operator was assumed to rely on a cash bond. The cost of the bond is modeled as the foregone interest that the miner would have earned on the bond amount.

The medium-size exploration model was assumed to require a Notice under the existing regulations. Under the proposed regulations the operation would be required to file a Plan. This operation was modeled as disturbing 4 acres. Baseline permit costs were assumed to be $1,000. It was assumed that this operation would be completed in under a year.

The primary factors responsible for the cost increases were bonding and permitting. The model assumed that a bond could be obtained for a cost equivalent to10% of the total reclamation cost. Results for both models were calculated with and without a validity exam. Validity exams were estimated to cost $10,000 per exam. For relatively small operations–such as many exploration activities–validity exam costs could represent a significant portion of permitting costs.

Increases in the magnitude of the permitting cost significantly affects any potential cost increases. For both of the exploration models there would be a distribution of permit costs under the proposed regulations. But data is not readily available to characterize these distributions. For the

medium exploration model, permit costs were assumed to increase from a baseline level of $1,000 by $2,000 to $100,000, with the permit costs evenly distributed between the levels. Results from the model suggests that cost increases would range from 5% to 48%, with the weighted average cost increase being 24.4%. If a validity exam were not required, the range of cost increases would be 1% to 44%, with a weighted average of 20.1%.

For the small exploration model, permitting costs were assumed to increase from a baseline level of $200 to between $500 and $20,000. The extent to which costs increase depends on whether validity exams are required and whether BLM bears any of the increased permitting costs. It is likely that not all exploration activities will require validity exams, and in some cases BLM may bear some of the permitting costs. For the case where a validity exam is required and BLM does not bear any of the permitting costs, the cost increases could range from 54% to 150%. The high estimate is based on permit costs increasing from $200 to $20,000. The low estimate is based on permit costs increasing from $200 to $500. If a validity exam is not required, the cost increases are smaller: the range is 8% to 104%. The low estimate is based on permit costs increasing from $200 to $500; the high estimate is based on permit costs increasing from $200 to $20,000. If BLM bears all of the permitting costs and no validity exam is required, the cost increase is estimated at about 2%. The wide range of cost estimates generated by this model highlights the difficulty in estimating the potential cost increases associated with the regulation.

The large percentage cost increases for the exploration models need to be put in perspective. For the medium exploration model, baseline permit cost were modeled at $1,000; for the small exploration model these costs were modeled as being basically $0. In both cases, large percentage increases can be generated by relatively small absolute cost changes. Cost changes in the order of several hundred dollars–or even several thousands of dollars-- would be unlikely to have significant impacts, but do generate large percentage changes. But permit costs that increased from a baseline level of $0 to $50,000 or $100,000 could have significant impacts over the longer term.

APPENDIX F
PLANT AND ANIMAL LISTS

CONTENTS

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands

FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

State	Class	Common Name	Scientific Name	Status
Alaska				
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Short-tailed albatross	Phoebastris albatrus	PE
	Bird	Spectacled eider	Somateria fischeri	FT
	Bird	Stellar's eider	Polystricta stelleri	FT
	Mammal	Canada lynx	Lynx canadensis	FT
	Mammal	Steller's (Northern) sea lion	Eumetopias jubatus	FT
Arizona				
	Amphibia	Sonora tiger salamander	Ambystoma tigrinum stebbinsi	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	Cactus ferruginous pygmy-owl	Glaucidium brasilianum cactorum	FE
	Bird	California condor	Gymnogyps californianus	FE (XN)
	Bird	Mexican spotted owl	Strix occidentalis lucida	FT
	Bird	Northern aplomado falcon	Falco femoralis septentrionalis	FE
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Bird	Whooping crane	Grus americana	FE
	Bird	Yuma clapper rail	Rallus longirostris yumanensis	FE
	Fish	Beautiful shiner	Cyprinella formosa	FT
	Fish	Bonytail chub	Gila elegans	FE
	Fish	Colorado squawfish	Ptychocheilus lucius	FE
	Fish	Desert pupfish	Cyprinodon macularius	FE
	Fish	Gila topminnow	Poeciliopsis occidentalis	FE
	Fish	Little Colorado spinedace	Lepidomeda vittata	FT
	Fish	Loach minnow	Rhinichthys (=Tiaroga) cobitis	FT
	Fish	Razorback sucker	Xyrauchen texanus	FE
	Fish	Sonora chub	Gila ditaenia	FT
	Fish	Spikedace	Meda fulgida	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Virgin River chub	Gila robusta seminuda	FE
Fish	Woundfin	Plagopterus argentissimus	FE
Fish	Yaqui catfish	Ictalurus pricei	FT
Fish	Yaqui chub	Gila prupurea	FE
Fish	Yaqui topminnow	Poeciliopsis occidentalis sonoriensis	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Hualapai Mexican vole	Microtus mexcanus hualapaiensis	FE
Mammal	Jaguar	Panthera onca	FE
Mammal	Jaguarundi	Felis yaguarundi	FE
Mammal	Lesser long-nosed bat	Leptonycteris curasoae yerbabuenae	FE
Mammal	Mexican gray wolf	Canis lupus baileyi	FE
Mammal	Ocelot	Felis pardalis	FE
Mammal	Sonoran pronghorn	Antilocapra americana	FE
Mollusk	Kanab ambersnail	Oxyloma Haydeni kanabensis	FE
Plant	Arizona agave	Agave arizonica	FE
Plant	Arizona cliffrose	Purshia subintegra	FE
Plant	Arizona hedgehog cactus	Echinocereus triglochidiatus arizonicus	FE
Plant	Brady pincushion cactus	Pediocactus bradyi	FE
Plant	Canelo Hills ladies tresses	Spiranthes delitescens	FE
Plant	Cochise pincushion cactus	Coryphantha robbinsorum	FT
Plant	Huachuca water umbel	Lilaeopsis schaffneriana ssp recurva	FE
Plant	Jones cycladenia	Cycladenia humilis var. jonesii	FT
Plant	Kearneys blue star	Amsonia kearneyana	FE
Plant	Nichol's Turk's head cactus	Echinocactus horizonthalonius var. nicholii	FE
Plant	Peebles Navajo cactus	Pediocactus peeblesianus var. peeblesianus	FE
Plant	Pima pineapple cactus	Coryphantha scheeri var. robustispina	FE
Plant	Siler pincushion cactus	Pediocactus sileri	FT
Plant	Welsh's milkweed	Asclepias welshii	FT
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Reptile	New Mexican ridge-nosed rattlesnake	Crotalus willardi obscurus	FT
Californi				
	Amphibia	California red-legged frog	Rana aurora draytonii	FT
	Amphibia n	Desert slender salamander	Batrachoseps aridis	FE
	Arthropo	Conservancy fairy shrimp	Branchinecta conservatio	FE
	Arthropo	Kern primrose sphinx moth	Euproserpinus euterpe	FT
	Arthropo	Longhorn fairy shrimp	Branchinecta longiantenna	FE
	Arthropo	Valley elderberry longhorn beetle	Desmocerus californicus dimorphus	FT
	Arthropo	Vernal pool fairy shrimp	Branchinecta lynchi	FE
	Arthropo	Vernal pool tadpole shrimp	Lepidurus packardi	FE
	Bird	Aleutian Canada goose	Branta canadensis leucopareia	FT
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	California condor	Gymnogyps californianus	FE
	Bird	Coastal California gnatcatcher	Polioptila californica californica	FT
	Bird	Inyo California (=brown) towhee	Pipilo crissalis eremophilus	FT
	Bird	Least Bell's vireo	Vireo bellii pusillus	FE
	Bird	Marbled murrelet	Brachyramphus marmoratus marmoratus	FT
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Northern spotted owl	Strix occidentalis caurina	FT
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Bird	Yuma clapper rail	Rallus longirostris yumanensis	FE
	Fish	Cowhead Lake tui chub	Gila bicolor vaccaceps	PE
	Fish	Desert pupfish	Cyprinodon macularius	FE
	Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
	Fish	Lost River sucker	Deltistes (=Catostomus) luxatus	FE
	Fish	Modoc sucker	Catostomus microps	FE
	Fish	Mohave tui chub	Gila bicolor mohavensis	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Owens pupfish	Cyprinodon radiosus	FE
Fish	Owens tui chub	Gila bicolor snyderi	FE
Fish	Shortnose sucker	Chasmistes brevirostris	FE
Fish	Unarmored three-spine stickleback	Gasterosteus aculeatus williamsoni	FE
Fish*	Chinook salmon, winter-run	Oncorhynchus tshawytscha	FE
Fish*	Coho salmon (Central California ESU)	Oncorhynchus kisutch	FT
Fish*	Coho salmon (Southern OR/Nortern	Oncorhynchus kisutch	FT
Fish*	Steelhead trout (CA Central Valley ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Central CA Coast ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Klamath Mountain Province ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Northern CA ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Southern CA ESU)	Oncorhynchus mykiss	FE
Mammal	Amargosa vole	Microtus californicus scirpensis	FE
Mammal	Fresno kangaroo rat	Dipodomys nitratoides exilis	FE
Mammal	Giant kangaroo rat	Dipodomys ingens	FE
Mammal	Peninsular bighorn sheep	Ovis canadensis cremnobates	FE
Mammal	San Joaquin kit fox	Vulpes macrotis mutica	FE
Mammal	San Joaquin Valley woodrat	Neotoma fuscipes riparia	PE
Mammal	Stephen's kangaroo rat	Dipodomys stephensi	FE
Mammal	Tipton kangaroo rat	Dipodomys nitratoides nitratoides	FE
Plant	Amargosa niterwort	Nitrophila mohavensis	FE
Plant	Ash Meadows gumplant	Grindelia fraxino-pratensis	FT
Plant	Bakersfield cactus	Opuntia treleasei	FE
Plant	Beach layia	Layia carnosa	FE
Plant	California jewelflower	Caulanthus californicus	FE
Plant	Coachella Valley milk-vetch	Astragalus lentiginosus var. coachellae	FT
Plant	Cushenberry buckwheat	Eriogonum ovalifolium var. vineum	FE
Plant	Cushenberry milk-vetch	Astragalus albens	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Plant	Cushenberry oxytheca	Oxytheca parishii var. goodmaniana	FE
Plant	El Dorado bedstraw	Galium californicum ssp. sierrae	FE
Plant	Fish Slough milk-vetch	Astragalus lentiginosus var. piscinensis	PE
Plant	Fleshy owl's clover	Castilleja campestris ssp. succulenta	FT
Plant	Hoover's woolystar	Eriastrum hooveri	FT
Plant	Indian Knob mountain balm	Eriodictyon altissimum	FE
Plant	Ione manzanita	Arctostaphylos myrtifolia	FT
Plant	Kern mallow	Eremalche kernensis	FE
Plant	Lane Mtn. milk-vetch	Astragalus jaegerianus	FE
Plant	Layne's butterweed	Senecio layneae	FT
Plant	McDonald's rock-cress	Arabis mcdonaldiana	FE
Plant	Menzies' wallflower	Erysimum menziesii	FE
Plant	Mexican fremontia	Fremontodendron mexicanum	FE
Plant	Munz's onion	Allium munzii	FE
Plant	Nevin's barberry	Berberis nevinii	FE
Plant	Otay tarplant	Hemizonia conjugens	FT
Plant	Parish's daisy	Erigeron parishii	FT
Plant	Peirson's milk-vetch	Astragalus magdalenae var. peirsonii	FT
Plant	Pine Hill ceanothus	Ceanothus roderickii	FE
Plant	Pine Hill flannelbush	Fremontodendron californicum ssp. decumbens	FE
Plant	Red Hills vervain	Verbena californica	FT
Plant	San Benito evening-primrose	Camissonia benitensis	FT
Plant	San Jacinto Valley crownscale	Atriplex coronata var. Notatior	FE
Plant	San Joaquin Valley orcutt grass	Orcuttia inaequalis	FT
Plant	San Joaquin woolly threads	Lembertia congdonii	FE
Plant	Santa Ana River woolystar	Eriastrum densifolium ssp. sanctorum	FE
Plant	Slender orcutt grass	Orcuttia tenuis	FT
Plant	Slender-horned spineflower	Dodecahema leptoceras	FE
Plant	Spring-loving centaury	Centaurium namophilum	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Plant	Springville clarkia	Clarkia springvillensis	PT
Plant	Stebbins' morning glory	Calystegia stebbinsii	FE
Plant	Thread-leaved brodiaea	Brodiaea filifolia	FT
Plant	Triple-ribbed milkvetch	Astragalus tricarinatus	FE
Reptile	Blunt-nosed leopard lizard	Gambelia silus	FE
Reptile	Coachella Valley fringe-toed lizard	Uma inornata	FT
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT
Reptile	Giant garter snake	Thamnophis gigas	FT
Colorado			
Arthropo	Pawnee montane skipper	Hesperia leonardus montana	FT
Arthropo	Uncomphagre fritillary butterfly	Boloria improba acrocnema	FE
Bird	American peregrine falcon	Falco peregrinus anatum	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Eskimo curlew	Numenius borealis	FE
Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mexican spotted owl	Strix occidentalis lucida	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Piping plover	Charadrius melodus	FT
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Bird	Whooping crane	Grus americana	FE
Fish	Bonytail chub	Gila elegans	FE
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Greenback cutthroat trout	Oncorhynchus clarki stomias	FT
Fish	Humpback chub	Gila cypha	FE
Fish	Pallid sturgeon	Scaphirhynchus albus	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE (XN)
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Canada lynx	Lynx canadensis	FT
Mammal	Gray wolf	Canis lupus	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Preble's meadow jumping mouse	Zapus hudsonius preblei	FT
Plant	Clay-loving wild buckwheat	Eriogonum pelinophilum	FE
Plant	Colorado butterfly plant	Gaura neomexicana ssp. coloradensis	PT
Plant	Dudley bluffs bladderpod	Lesquerella congesta	FT
Plant	Knowlton cactus	Pediocactus knowltonii	FE
Plant	Mancos milk-vetch	Astragalus humillimus	FE
Plant	Mesa Verde cactus	Sclerocactus mesae-verdae	FT
Plant	North Park phacelia	Phacelia formosula	FE
Plant	Osterhout milkvetch	Astragalus osterhoutii	FE
Plant	Penland alpine fen mustard	Eutrema penlandii	FT
Plant	Piceance twinpod	Physaria obcordata	FT

Idaho

Bird	American peregrine falcon	Falco peregrinus anatum	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT
Bird	Whooping crane	Grus americana	FE
Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
Fish	Bull trout (Jarbridge River pop)	Salvelinus confluentus	FE
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
Fish	Kootenai River white sturgeon	Acipenser transmontanus	FE
Fish	Sockeye salmon	Oncorhynchus nerka	FE
Fish*	Chinook salmon, fall run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Chinook salmon, spring/summer run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Steelhead trout (Snake River Basin ESU)	Oncorhynchus mykiss	FT
Mammal	Gray wolf	Canis lupus	FE
Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Lynx	Lynx canadensis	FT
Mammal	Northern Idaho ground squirrel	Spermophilus brunneus brunneus	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Mammal	Woodland (Mountain) caribou	Rangifer tarandus caribou	FE
	Mollusk	Banbury Springs limpet	Lanx sp.	FE
	Mollusk	Bliss Rapids snail	Taylorconcha serpenticola	FT
	Mollusk	Bruneau Hot Springsnail	Pyrgulopsis bruneauensis	FE
	Mollusk	Idaho springsnail	Pyrgulopsis idahoensis	FE
	Mollusk	Snake River physa snail	Physa natricina	FE
	Mollusk	Utah valvata snail	Valvata utahensis	FE
	Plant	Macfarlanes four-o'clock	Mirabilis macfarlanei	FT
	Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
	Plant	Water howellia	Howellia aquatilis	FT
Montana				
	Arthropo	American burying beetle	Nicrophorus americanus	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Least tern (interior pop.)	Sterna antillarum	FE
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
	Bird	Piping plover	Charadrius melodus	FT
	Bird	Whooping crane	Grus americana	FE
	Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
	Fish	Pallid sturgeon	Scaphirhynchus albus	FE
	Mammal	Black-footed ferret	Mustela nigripes	FE
	Mammal	Gray wolf	Canis lupus	FE
	Mammal	Grizzly (=brown) bear	Ursus arctos	FT
	Mammal	Lynx	Lynx canadensis	FT
N.				
	Arthropo	Socorro isopod	Exosphaeroma thermophilus	FE
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mexican spotted owl	Strix occidentalis lucida	FT
Bird	Mountain plover	Charadrius montanus	PT
Bird	Northern aplomado falcon	Falco femoralis septentrionalis	FE
Bird	Piping plover	Charadrius melodus	FT
Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
Bird	Whooping crane	Grus americana	FE
Fish	Arkansas River shiner	Notropis girardi	FT
Fish	Beautiful shiner	Cyprinella formosa	FT
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Gila topminnow	Poeciliopsis occidentalis	FE
Fish	Gila trout	Oncorhynchus gilae	FE
Fish	Loach minnow	Rhinichthys (=Tiaroga) cobitis	FT
Fish	Pecos bluntnose shiner	Notropis simus pecosensis	FT
Fish	Pecos gambusia	Gambusia nobilis	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Fish	Rio Grande silvery minnow	Hybognathus amarus	FE
Fish	Spikedace	Meda fulgida	FT
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Jaguar	Panthera onca	FE
Mammal	Lesser long-nosed bat	Leptonycteris curasoae yerbabuenae	FE
Mammal	Mexican gray wolf	Canis lupus baileyi	FE
Mammal	Mexican long-nosed bat	Leptonycteris nivalis	FE
Mollusk	Alamosa springsnail	Tryonia alamosae	FE
Mollusk	Socorro Springsnail	pyrgulopsis neomexicana	FE
Plant	Gypsum wild-buckwheat	Eriogonum gypsophilum	FT
Plant	Holy Ghost ipomopsis	Ipomopsis sancti-spiritus	FE
Plant	Knowlton cactus	Pediocactus knowltonii	FE
Plant	Kuenzler hedgehog cactus	Echinocereus fendleri var. Kuenzleri	FE
Plant	Lee pincushion cactus	Coryphantha sneedii var. leei	FT

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Plant	Mancos milk-vetch	Astragalus humillimus	FE
	Plant	Mesa Verde cactus	Sclerocactus mesae-verdae	FT
	Plant	Sacramento prickly poppy	Argemone Plieiacantha ssp.pinnatisecta	FE
	Plant	Sneed pincushion cactus	Coryphantha sneedii var. sneedii	FE
	Plant	Todsen's pennyroyal	Hedeoma todsenii	FE
	Plant	Zuni (=rhizome) fleabane	Erigeron rhizomatus	FT
	Reptile	New Mexican ridge-nosed rattlesnake	Crotalus willardi obscurus	FT
Nevada				
	Arthropo	Ash Meadows naucorid bug	Ambrysus amargosus	FT
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Fish	Ash Meadows Amargosa pupfish	Cyprinodon nevadensis mionectes	FE
	Fish	Big Spring spinedace	Lepidomeda mollispinis pratensis	FT
	Fish	Bonytail chub	Gila elegans	FE
	Fish	Bull trout (Jarbridge River pop)	Salvelinus confluentus	FE
	Fish	Clover Valley speckled dace	Rhinichthys osculus oligoporus	FE
	Fish	Cui-ui	Chasmistes cujus	FE
	Fish	Desert dace	Eremichthys acros	FT
	Fish	Devil's Hole pupfish	Cyprinodon diabolis	FE
	Fish	Hiko White River springfish	Crenichthys baileyi grandis	FE
	Fish	Independence Valley speckled dace	Rhinichthys osculus lethoporus	FE
	Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
	Fish	Moapa dace	Moapa coriacea	FE
	Fish	Nevada speckled dace	Rhinichthys osculus nevadensis	FE
	Fish	Pahranagat roundtail chub	Gila robusta jordani	FE
	Fish	Pahrump poolfish	Empetrichthys latos	FE
	Fish	Railroad Valley springfish	Crenichthys nevadae	FT
	Fish	Razorback sucker	Xyrauchen texanus	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Fish	Virgin River chub	Gila robusta seminuda	FE
	Fish	Warm Springs pupfish	Cyprinodon nevadensis pectoralis	FE
	Fish	Warner sucker	Catostomus warnerensis	FT
	Fish	White River spinedace	Lepidomeda albivallis	FE
	Fish	White River springfish	Crenichthys baileyi baileyi	FE
	Fish	Woundfin	Plagopterus argentissimus	FE
	Plant	Amargosa niterwort	Nitrophila mohavensis	FE
	Plant	Ash Meadows blazingstar	Mentzelia leucophylla	FT
	Plant	Ash Meadows gumplant	Grindelia fraxino-pratensis	FT
	Plant	Ash Meadows ivesia	Ivesia kingii var. eremica	FT
	Plant	Ash Meadows milkvetch	Astragalus phoenix	FT
	Plant	Ash Meadows sunray	Enciliopsis nudicaulis var. corrugata	FT
	Plant	Spring-loving centaury	Centaurium namophilum	FT
	Plant	Steamboat buckwheat	Eriogonum ovalifolium var. williamsiae	FE
	Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
	Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT
Oregon				
	Arthropo	Fender's blue butterfly	Icaricia icarioides fenderi	FE
	Arthropod	Oregon silverspot butterfly	Speyeria zerene hippolyta	FT
	Bird	Aleutian canada goose	Branta canadensis leucopareia	FT
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Brown pelican	Pelecanus occidentalis	FE
	Bird	California condor	Gymnogyps californianus	FE
	Bird	Eskimo curlew	Numenius borealis	FE
	Bird	Marbled murrelet	Brachyramphus marmoratus marmoratus	FT
	Bird	Northern spotted owl	Strix occidentalis caurina	FT
	Bird	Peregrine falcon	Falco peregrinus	FE (S/A)

Appendix F: Plant and Animal Lists

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Bird	Short-tailed albatross	Phoebastris albatrus	PE
Bird	Western snowy plover (coastal pop)	Charadrius alexandrinus nivosus	FT
Fish	Borax lake chub	Gila boraxobius	FE
Fish	Bull trout (Columbia River pop)	Salvelinus confluentus	FT
Fish	Bull trout (Klamath River pop)	Salvelinus confluentus	FT
Fish	Foskett speckled dace	Rhinichthys osculus ssp. 3	FT
Fish	Hutton tui chub	Gila bicolor ssp. 1	FT
Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
Fish	Lost River sucker	Deltistes (=Catostomus) luxatus	FE
Fish	Oregon chub	Oregonichthys (=Hybopsis) crameri	FE
Fish	Shortnose sucker	Chasmistes brevirostris	FE
Fish	Warner sucker	Catostomus warnerensis	FT
Fish*	Chinook salmon, fall run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Chinook salmon, spring/summer run (Snake River pop)	Oncorhynchus tshawytscha	FT
Fish*	Coho salmon (Oregon Coast ESU)	Oncorhynchus kisutch	FT
Fish*	Coho salmon (Southern OR/Nortern	Oncorhynchus kisutch	FT
Fish*	Sockeye salmon, snake river runs	Oncorhynchus nerka	FE
Fish*	Steelhead trout (Klamath Mountain Province ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Middle Columbia River ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Oregon Coast ESU)	Oncorhynchus mykiss	PT
Fish*	Steelhead trout (Snake River Basin ESU)	Oncorhynchus mykiss	FT
Fish*	Steelhead trout (Upper Columbia River ESU)	Oncorhynchus mykiss	FE
Fish*	Umpqua river cutthroat trout	Oncorhynchus clarki clarki	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Columbian white-tailed deer	Odocoileus virginianus leucurus	FE
Mammal	Gray wolf	Canis lupus	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

	Mammal	Grizzly (=brown) bear	Ursus arctos	FT
	Mammal	Lynx	Lynx canadensis	FT
	Mammal	Woodland (Mountain) caribou	Rangifer tarandus caribou	FE
	Plant	Applegate's milk-vetch	Astragalus applegatei	FE
	Plant	Bradshaw's lomatium/Desert-parsley	Lomatium bradshawii	FE
	Plant	Gentner's fritillaria	Fritillaria gentneri	FE
	Plant	Golden paintbrush	Castilleja levisecta	FT
	Plant	Hairy popcorn flower or rough allocarya	Plagiobothrys hirtus	FE
	Plant	Howell's spectacular thelypody	Thelypodium howellii ssp. Spectabilis	FT
	Plant	Kincaid's lupine	Lupinus sulphureus ssp. Kincaidii	FT
	Plant	Macfarlanes four-o'clock	Mirabilis macfarlanei	FT
	Plant	Malheur wire-lettuce	Stephanomeria malheurensis	FE
	Plant	Marsh sandwort	Arenaria paludicola	FE
	Plant	Nelson's checkermallow	Sidalcea nelsoniana	FT
	Plant	Oregon checkermallow	Sidalcea oregana var. Calva	FE
	Plant	Water howellia	Howellia aquatilis	FT
	Plant	Western lily	Lilium occidentale	FE
	Plant	Willamette daisy	Erigeron decumbens var. Decumbens	FE
Utah				
	Bird	American peregrine falcon	Falco peregrinus anatum	FE
	Bird	Bald eagle	Haliaeetus leucocephalus	FT
	Bird	Mexican spotted owl	Strix occidentalis lucida	FT
	Bird	Mountain plover	Charadrius montanus	PT
	Bird	Southwestern willow flycatcher	Empidonax traillii extimus	FE
	Bird	Whooping crane	Grus americana	FE
	Fish	Bonytail chub	Gila elegans	FE
	Fish	Colorado squawfish	Ptychocheilus lucius	FE
	Fish	Humpback chub	Gila cypha	FE
	Fish	Lahontan cutthroat trout	Oncorhynchus clarki henshawi	FT
	Fish	Razorback sucker	Xyrauchen texanus	FE

Endangered, Threatened, and Proposed Species Known to Occur on BLM -Administered Lands
FE= federally endangered; FT=federally threatened; PE=proposed endangered; PT=proposed threatened

Fish	Virgin River chub	Gila robusta seminuda	FE
Fish	Woundfin	Plagopterus argentissimus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Black-footed ferret	Mustela nigripes	FE (XN)
Mammal	Lynx	Lynx canadensis	FT
Mammal	Utah prairie dog	Cynomys parvidens	FT
Mollusk	Kanab ambersnail	Oxyloma Haydeni kanabensis	FE
Plant	Barneby reed-mustard	Schoenocrambe barneby	FE
Plant	Barneby ridge-cress	Lepidium barnebyanum	FE
Plant	Clay reed-mustard	Schoenocrambe argillacea	FT
Plant	Deseret milk-vetch	Astragalus desereticus	FT
Plant	Dwarf bear-claw poppy	Arctomecon humilis	FE
Plant	Jones cycladenia	Cycladenia humilis var. jonesii	FT
Plant	Kodachrome bladderpod	Lesquerella tumulosa	FE
Plant	Last Chance townsendia	Townsendia aprica	FT
Plant	Maguire daisy	Erigeron maguirei	FT
Plant	Navajo sedge	Carex specuicola	FT
Plant	San Rafael cactus	Pediocactus despainii	FE
Plant	Shrubby reed-mustard	Schoenocrambe suffrutescens	FE
Plant	Siler pincushion cactus	Pediocactus sileri	FT
Plant	Uinta Basin hookless cactus	Sclerocactus glaucus	FT
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT
Plant	Welsh's milkweed	Asclepias welshii	FT
Plant	Winkler cactus	Pediocactus winkleri	FT
Plant	Wright fishhook cactus	Sclerocactus wrightiae	FE
Reptile	Desert tortoise (Mojave pop.)	Gopherus agassizii	FT

Wyoming

Amphibia	Wyoming toad	Bufo hemiophyrs baxteri	FE
Arthropo	American burying beetle	Nicrophorus americanus	FE
Bird	Bald eagle	Haliaeetus leucocephalus	FT

Bird	Eskimo curlew	Numenius borealis	FE
Bird	Least tern (interior pop.)	Sterna antillarum	FE
Bird	Mountain plover	Charadrius montanus	PT
Bird	Peregrine falcon	Falco peregrinus	FE (S/A)
Bird	Piping plover	Charadrius melodus	FT
Bird	Whooping crane	Grus americana	FE
Fish	Bonytail chub	Gila elegans	FE
Fish	Colorado squawfish	Ptychocheilus lucius	FE
Fish	Humpback chub	Gila cypha	FE
Fish	Kendall Warm Springs dace	Rhinichthys osculus thermalis	FE
Fish	Pallid sturgeon	Scaphirhynchus albus	FE
Fish	Razorback sucker	Xyrauchen texanus	FE
Mammal	Black-footed ferret	Mustela nigripes	FE
Mammal	Gray wolf	Canis lupus	FE
Mammal	Grizzly (=brown) bear	Ursus arctos	FT
Mammal	Lynx	Lynx canadensis	FT
Mammal	Preble's meadow jumping mouse	Zapus hudsonius preblei	FT
Plant	Colorado butterfly plant	Gaura neomexicana ssp. coloradensis	PT
Plant	Desert Yellowhead	Yermo xanthocephalus	PT
Plant	Ute ladies'-tresses	Spiranthes diluvialis	FT

Amphibians and Reptiles Designated as Sensitive Species by BLM State Offices

Amargosa toad	Glen Canyon chuckwalla	Ringneck snake
Arizona toad	Gray-checkered whiptail	Rosy boa
Arizona skink	Great Plains rat snake	Sacramento Mountain salamander
Banded Gila monster	Jemez Mountain salamander	Smooth green snake
Blanchard's cricket frog	Larch Mountain salamander	Snapping turtle
California king snake	Longnose leopard lizard	Sonora lyre snake
Canadian toad	Lowland leopard frog	Sonora tiger salamander
Canyon spotted whiptail	Massasauga	Southern torrent salamander
Canyon whiptail	Mexican garter snake	Southwestern black snake
Cascades frog	Midget-faded rattlesnake	Southwestern speckled rattlesnake
Chuckwalla	Milk snake	Spiny softshell turtle
Coeur d'Alene salamander	Mojave black-collard lizard	Spotted frog
Collard lizard (Mojave black)	Mojave Desert sidewinder	Tailed frog
Common kingsnake	Mojave patch-nosed snake	Tarahumara frog
Cowles fringe-toed lizard	Narrow-headed garter snake	Texas horned lizard
Desert night lizard	Narrowhead garter snake	Utah banded gecko
Desert spiny lizard	Northern leopard frog	Utah blind snake
Desert iguana	Northern red-legged frog	Utah milk snake
Desert tortoise (Sonoran Desert)	Northern sagebrush lizard	Utah mountain king snake
Desert glossy snake	Northwestern pond turtle	Western toad
Desert horned lizard	Pacific chorus frog	Western chuckwalla
Dunes sagebrush lizard	Painted Desert glossy snake	Western ground snake
Eastern short-horned lizard	Plains leopard frog	Wood frog
Flat-tailed horned lizard	Plateau striped whiptail	

Matrix of Regional Priority Bat Species Developed by the Bat Working Group (1998)						
Species	Region 1	Region 2	Regions 3, 4, 9, 10	Region 5	Region 6	Regions 7, 8
MULTIPLE HABITAT BATS						
Southwestern myotis						M
California myotis	L	M	L	L	M	L
Western small-footed myotis	P	M	L	M	M	M
Long-eared myotis	M	M	L	M	M	M
Keen's myotis	H					
Little brown bat	L	L	L	M	M	M
Arizona myotis						M
Northern myotis			L			
Fringed myotis	H	H	M	H	H	M
Long-legged myotis	M	M	L	H	L	M
Yuma myotis	L	M	L	L	M	L
Big brown bat	L	L	L	L	L	L
Lappet-eared bat					H	H
Pallid bat	H	M	L	H	M	L
Mexican free-tailed bat	L		L	L	M	L
TREE-ROOSTING BATS						
Western red bat				H	H	H
Eastern red bat			L			
Hoary bat	M	M	M	M	M	M
Western yellow bat				H		H
Silver-haired bat	M	M	M	M	M	M
H = high priority; M = medium priority; L = low priority; P = periphery (species on the edge of its range).						

Matrix of Regional Priority Bat Species Developed by the Bat Working Group (1998)						
Species	Region 1	Region 2	Regions 3, 4, 9, 10	Region 5	Region 6	Regions 7, 8
CLIFF-ROOSTING BATS						
Western pipestrelle	P	L	L	L	M	L
Spotted bat	P	H	M	H	H	M
Pocketed free-tailed bat				M		M
Big free-tailed bat			L	M	H	M
Western mastiff bat				H	H	M
Underwood's mastiff bat						M
CAVE-ROOSTING BATS						
Ghost-faced bat						M
California leaf-nosed bat				H		H
Mexican long-tongued bat				M		H
Lesser long-nosed bat						H
Big long-nosed bat						H
Cave myotis			L			M
Townsend's big-eared bat	H	H	H	H	H	H
H = high priority; M = medium priority; L = low priority; P = periphery (species on the edge of its range).						

Appendix F: Plant and Animals Lists

Map of Regions used by Bat Working Group

Partners In Flight Western Working Group Group Priority Bird Species in the Western U.S. 177 Species on the List of One or More States

10 October 1997

Abert's Towhee
American Pipit
American Redstart
American Bittern
Aplomado Falcon
Arctic Warbler
Baird's Sparrow (3)
Bald Eagle (3)
Band-tailed Pigeon (3)
Bank Swallow (3)
Bell's Vireo (5)
Belted Kingfisher
Bendire's Thrasher (2)
Black-billed Cuckoo
Black-throated Gray Warbler (5)
Black Swift (5)
Black Rail
Black Tern (2)
Black-throated Sparrow (2)
Black-backed Woodpecker
Black-chinned Sparrow
Black-shouldered Kite
Blackpoll Warbler
Blue Grosbeak (2)
Blue Grouse
Blue-gray Gnatcatcher
Blue-throated Hummingbird
Bobolink (2)
Bohemian Waxwing
Boreal Owl (2)
Botteri's Sparrow (2)
Brewer's Sparrow (7)
Broad-billed Hummingbird
Brown Pelican (California)
Brown-capped Rosy Finch
Brown Creeper
Buff-breasted Flycatcher
Burrowing Owl (8)
Caspian Tern
Cassin's Sparrow (2)
Cassin's Vireo
Chestnut-collared Longspur (3)
Chestnut-backed Chickadee
Chipping Sparrow
Common Yellowthroat (2)
Common Ground Dove
Common Black-Hawk (2)
Common Tern
Cooper's Hawk (2)
Cordilleran Flycatcher (4)
Costa's Hummingbird
Dickcissel
Eastern Bluebird
Elegant Trogon (2)
Elf Owl
Ferruginous Hawk (10)
Ferruginous Pygmy-Owl
Flammulated Owl (2)
Forster's Tern
Franklin's Gull
Gila Woodpecker
Golden-crowned Kinglet (2)
Golden Eagle
Grace's Warbler (4)
Grasshopper Sparrow (4)
Gray Catbird (2)
Gray Flycatcher (6)
Gray Hawk
Gray Vireo (6)
Gray-cheeked Thrush
Greater Pewee
Greater Prairie-Chicken
Green-tailed Towhee
Gyrfalcon
Hammond's Flycatcher (6)
Harlequin Duck
Harris' Hawk
Hermit Warbler
Hooded Oriole
Lark Bunting (3)
Le Conte's Thrasher (2)
Least Flycatcher
Least Tern (4)
Lesser Prairie-Chicken (2)
Lewis' Woodpecker (5)
Lincoln's Sparrow
Loggerhead Shrike (6)
Long-billed Curlew (7)
Long-eared Owl (2)
Lucifer Hummingbird
Lucy's Warbler (4)
MacGillivray's Warbler (7)
Marsh Wren
McCown's Longspur (3)
McKay's Bunting
Montezuma Quail
Mountain Plover (5)
Mountain Bluebird
Northern Beardless-Tyrannulet
Northern Goshawk (6)
Northern Harrier
Northern Shrike
Northern Waterthrush
Northwestern Crow
Olive-sided Flycatcher (11)
Olive Warbler
Orange-crowned Warbler
Orchard Oriole
Osprey
Pacific-slope Flycatcher
Painted Bunting
Peregrine Falcon (3)
Phainopepla
Pileated Woodpecker
Pinyon Jay
Piping Plover (2)
Prairie Falcon
Purple Martin (2)
Red-breasted Sapsucker
Red-eyed Vireo (2)
Red-naped Sapsucker (5)
Red-faced Warbler (2)
Red-headed Woodpecker
Red-shouldered Hawk
Rock Wren
Rufous Hummingbird (3)
Rufous-winged Sparrow
Rusty Blackbird
Sage Grouse (2)
Sage Sparrow (7)
Sage Thrasher (2)
Sandhill Crane (2)
Savannah Sparrow (2)
Scott's Oriole (2)
Sharp-shinned Hawk

Thick-billed Kingbird
Three-toed Woodpecker
Townsend's Warbler (4)
Tree Swallow
Tricolored Blackbird
Trumpeter Swan
Upland Sandpiper (3)
Varied BuntingVaried Thrush (2)
Vaux's Swift (5)
Veery (2)
Virginia's Warbler (6)
Warbling Vireo
Western Bluebird
Western Wood-Pewee
Western Screech-Owl
Whip-poor-will
Whiskered Screech-Owl
White-headed Woodpecker
Vermillion Flycatcher (2)
Violet-crowned Hummingbird (2)

Sharp-tailed Grouse (Columbian)
Short-eared Owl (2)
Siberian Tit
Smith's Longspur
Snowy Plover (4)
Spotted Owl (2)
Sprague's Pipit (2)
Summer Tanager (3)
Swainson's Hawk (2)
Swainson's Thrush

APPENDIX G
ECONOMICS

Figure G-1

Figure G-2

Figure G-3

Figure G-4

Table G-1. Gross State Product (GSP) for Study Area 1982, 1990, and 1997 (millions of 1992 chained dollars)							
State	1982	% of 1982 State Total	1990	% of 1990 State	1997	% of 1996 State Total	% Change 1982-1997
Alaska							
Total Gross State Product	$22,900	100.0%	$25,200	100.0%	$21,800	100.0%	-4.8%
Mining	$5,030	22.0%	$7,990	31.7%	$4,390	20.1%	-12.7%
Metal mining	$6	0.0%	$182	0.7%	$314	1.4%	5133.3%
Nonmetallic minerals, except fuels	$7	0.0%	$9	0.0%	$15	0.1%	114.3%
Arizona							
Total Gross State Product	$50,100	100.0%	$72,900	100.0%	$110,000	100.0%	119.6%
Mining	$479	1.0%	$813	1.1%	$1,410	1.3%	194.4%
Metal mining	$405	0.8%	$664	0.9%	$1,110	1.0%	174.1%
Nonmetallic minerals, except fuels	$27	0.1%	$38	0.1%	$90	0.1%	229.3%
California							
Total Gross State Product	$570,000	100.0%	$845,000	100.0%	$928,000	100.0%	62.8%
Mining	$5,400	0.9%	$5,390	0.6%	$5,460	0.6%	1.1%
Metal mining	$65	0.0%	$198	0.0%	$204	0.0%	213.8%
Nonmetallic minerals, except fuels	$378	0.1%	$690	0.1%	$947	0.1%	150.5%
Colorado							
Total Gross State Product	$67,800	100.0%	$79,000	100.0%	$113,000	100.0%	66.7%
Mining	$1,300	1.9%	$1,580	2.0%	$2,490	2.2%	91.5%
Metal mining	$194	0.3%	$83	0.1%	$122	0.1%	-37.1%
Nonmetallic minerals, except fuels	$40	0.1%	$48	0.1%	$114	0.1%	185.0%
Idaho							
Total Gross State Product	$14,700	100.0%	$18,500	100.0%	$27,300	100.0%	85.7%
Mining	$147	1.0%	$198	1.1%	$271	1.0%	84.4%
Metal mining	$78	0.5%	$104	0.6%	$125	0.5%	60.3%
Nonmetallic minerals, except fuels	$63	0.4%	95	0.5%	$146	0.5%	131.7%
Montana							
Total Gross State Product	$13,800	100.0%	$13,900	100.0%	$17,200	100.0%	24.6%
Mining	$750	5.4%	$769	5.5%	$952	5.5%	26.9%
Metal mining	$79	0.6%	$149	1.1%	$210	1.2%	165.8%
Nonmetallic minerals, except fuels	$39	0.3%	$71	0.5%	$77	0.4%	97.4%
Nevada							
Total Gross State Product	$21,000	100.0%	$33,100	100.0%	$50,200	100.0%	139.0%
Mining	$291	1.4%	$1,010	3.1%	$1,650	3.3%	467.0%
Metal mining	$199	0.9%	$893	2.7%	$1,550	3.1%	678.9%
Nonmetallic minerals, except fuels	$93	0.4%	$90	0.3%	$98	0.2%	5.4%
New Mexico							
Total Gross State Product	$25,100	100.0%	$27,900	100.0%	$43,500	100.0%	73.3%
Mining	$2,610	10.4%	$2,480	8.9%	$3,040	7.0%	16.5%
Metal mining	$157	0.6%	$200	0.7%	$209	0.5%	33.1%
Nonmetallic minerals, except fuels	$123	0.5%	$174	0.6%	$247	0.6%	100.8%
Oregon							
Total Gross State Product	$46,500	100.0%	$60,800	100.0%	$90,200	100.0%	94.0%
Mining	$60	0.1%	$88	0.1%	$122	0.1%	103.3%
Metal mining	$5	0.0%	$3	0.0%	$7	0.0%	40.0%
Nonmetallic minerals, except fuels	$42	0.1%	$74	0.1%	$110	0.1%	159.3%

Appendix G: Economics

Table G-1. Gross State Product (GSP) for Study Area 1982, 1990, and 1997 (millions of 1992 chained dollars)							
State	**1982**	**% of 1982 State Total**	**1990**	**% of 1990 State**	**1997**	**% of 1996 State Total**	**% Change 1982-1997**
Utah							
Total Gross State Product	$25,900	100.0%	$32,900	100.0%	$49,600	100.0%	91.5%
Mining	$654	2.5%	$1,300	4.0%	$1,690	3.4%	158.4%
Metal mining	$151	0.6%	$263	0.8%	$665	1.3%	340.4%
Nonmetallic minerals, except fuels	$49	0.2%	$84	0.3%	$66	0.1%	34.7%
Washington							
Total Gross State Product	$90,000	100.0%	$122,000	100.0%	$152,000	100.0%	68.9%
Mining	$115	0.1%	$259	0.2%	$328	0.2%	185.2%
Metal mining	$28	0.0%	$61	0.1%	$51	0.0%	82.1%
Nonmetallic minerals, except fuels	$66	0.1%	$134	0.1%	$193	0.1%	192.4%
Wyoming							
Total Gross State Product	$13,100	100.0%	$13,400	100.0%	$16,500	100.0%	26.0%
Mining	$3,100	23.7%	$4,250	31.7%	$5,310	32.2%	71.3%
Metal mining	$105	0.8%	$24	0.2%	$20	0.1%	-81.0%
Nonmetallic minerals, except fuels	$365	2.8%	$583	4.4%	$834	5.1%	128.5%
Study Area							
Total Gross State Product	$960,900	100.0%	$1,344,600	100.0%	$1,619,300	100.0%	68.5%
Mining	$19,936	2.1%	$26,127	1.9%	$27,113	1.7%	36.0%
Metal mining	$1,472	0.2%	$2,824	0.2%	$4,587	0.3%	211.6%
Nonmetallic minerals, except fuels	$1,292	0.1%	$2,090	0.2%	$2,937	0.2%	127.3%
Metals, nonmetals combined	$2,764	0.3%	$4,914	0.4%	$7,524	0.5%	172.2%
U.S. (GDP)							
Total Gross Domestic Product	$4,620,000	100.0%	$6,140,000	100.0%	$7,270,000	100.0%	57.4%
Mining	$78,800	1.7%	$96,900	1.6%	$110,000	1.5%	39.6%
Metal mining	$2,176	0.0%	$3,664	0.1%	$6,200	0.1%	184.9%
Nonmetallic minerals, except fuels	$5,000	0.1%	$7,755	0.1%	$10,800	0.1%	116.0%
Metals, nonmetals combined	$7,176	0.2%	$11,419	0.2%	$17,000	0.2%	136.9%
Study Area as % of U.S. Total							
Total GSP	20.8%	N/A	21.9%	N/A	22.3%	N/A	7.1%
Mining	25.3%	N/A	27.0%	N/A	24.6%	N/A	-2.6%
Metal mining	67.6%	N/A	77.1%	N/A	74.0%	N/A	9.4%
Nonmetallic minerals, except fuels	25.8%	N/A	27.0%	N/A	27.2%	N/A	5.2%
Metals, nonmetals combined	38.5%	N/A	43.0%	N/A	44.3%	N/A	14.9%
Source: U.S. Department of Commerce, Bureau of Economic Analysis 1998.							

Table G-2: Personal Income, Employment, and Population in Study Area 1980, 1990, 1998			
Category	**1980**	**1990**	**1998**
PERSONAL INCOME (million current dollars)			
Total Personal Income			
Study Area Total	$476,000	$1,060,000	$1,610,000
U.S. Total	$2,310,000	$4,890,000	$7,350,000
Study Area as Percent of U.S. Total	20.6%	21.6%	21.9%
Personal Income - Metal Mining			
Study Area Total	$1,920	$1,650	$2,160
U.S. Total	$3,170	$2,430	$2,880
Study Area as Percent of U.S. Total	60.5%	68.1%	74.9%
Personal Income - Nonmetallic Minerals, except fuels			
Study Area Total	$694	$948	$1,170
U.S. Total	$2,680	$4,230	$5,340
Study Area as Percent of U.S. Total	25.9%	22.4%	21.9%
Personal Income - Metals, Nonmetals combined			
Study Area Total	$2,610	$2,600	$3,330
U.S. Total	$5,850	$6,660	$8,230
Study Area as Percent of U.S. Total	44.6%	39.1%	40.4%
EMPLOYMENT (000)			
Total Employment			
Study Area Total	22,300	29,500	34,700
U.S. Total	114,000	139,000	160,000
Study Area as Percent of U.S. Total	19.6%	21.2%	21.7%
Employment - Metal Mining			
Study Area Total	65	42	43
U.S. Total	106	64	58
Study Area as Percent of U.S. Total	61.9%	65.9%	74.0%
Employment - Nonmetallic minerals, except fuels			
Study Area Total	29	24	23
U.S. Total	131	121	118
Study Area as Percent of U.S. Total	21.9%	20.0%	19.8%
Employment - Metals, Nonmetals combined			
Study Area Total	94	66	67
U.S. Total	237	185	177
Study Area as Percent of U.S. Total	39.8%	35.9%	37.8%
POPULATION (000)			
Study Area Total	42,500	52,000	59,100
U.S. Total	227,000	249,000	270,000
Study Area as Percent of U.S. Total	18.7%	20.9%	21.9%

Notes: All figures rounded to three significant digits.
Source: US Department of Commerce, BEA 2000.

Table G-3. Employment Trends in Study Area, 1980-1998							
State	1980	Percent of 1980 Total	1990	Percent of 1990 Total	1998	Percent of 1998 Total	Percent Change 1980-1998
Alaska							
Total	169,000	100.0%	233,000	100.0%	267,000	100.0%	58.0%
Total Private	115,000	68.0%	165,000	70.8%	199,000	74.5%	73.0%
Mining	6,680	4.0%	11,400	4.9%	10,400	3.9%	55.7%
Metal Mining	320	0.2%	1,060	0.5%	1,260	0.5%	293.8%
Nonmetallic minerals	0	N/A	0	N/A	0	N/A	N/A
Arizona							
Total	1,020,000	100.0%	1,500,000	100.0%	2,070,000	100.0%	102.9%
Total Private	825,000	80.9%	1,240,000	82.7%	1,770,000	85.5%	114.5%
Mining	21,100	2.1%	12,700	0.8%	12,700	0.6%	-39.8%
Metal Mining	19,200	1.9%	10,600	0.7%	10,700	0.5%	-44.3%
Nonmetallic minerals	658	0.1%	855	0.1%	1,050	0.1%	59.6%
California							
Total	10,100,000	100.0%	13,300,000	100.0%	14,000,000	100.0%	38.6%
Total Private	8,400,000	83.2%	11,300,000	85.0%	11,900,000	85.0%	41.7%
Mining	43,300	0.4%	40,100	0.3%	24,800	0.2%	-42.7%
Metal Mining	0	N/A	2,390	0.0%	1,610	0.0%	N/A
Nonmetallic minerals	7,960	0.1%	6,730	0.1%	5,230	0.0%	-34.3%
Colorado							
Total	1,230,000	100.0%	1,500,000	100.0%	2,030,000	100.0%	65.0%
Total Private	996,000	81.0%	1,240,000	82.7%	1,730,000	85.2%	73.7%
Mining	36,000	2.9%	19,800	1.3%	14,000	0.7%	-61.1%
Metal Mining	11,700	1.0%	3,440	0.2%	2,270	0.1%	-80.6%
Nonmetallic minerals	806	0.1%	985	0.1%	1,690	0.1%	109.7%
Idaho							
Total	316,000	100.0%	386,000	100.0%	526,000	100.0%	66.5%
Total Private	250,000	79.1%	309,000	80.1%	431,000	81.9%	72.4%
Mining	4,670	1.5%	3,870	1.0%	0	N/A	N/A
Metal Mining	3,100	1.0%	2,760	0.7%	1,690	0.3%	-45.5%
Nonmetallic minerals	1,400	0.4%	1,110	0.3%	1,190	0.2%	-15.0%
Montana							
Total	265,000	100.0%	287,000	100.0%	365,000	100.0%	37.7%
Total Private	204,000	77.0%	223,000	77.7%	294,000	80.5%	44.1%
Mining	8,850	3.3%	6,280	2.2%	5,160	1.4%	-41.7%
Metal Mining	1,920	0.7%	2,640	0.9%	1,830	0.5%	-4.7%
Nonmetallic minerals	841	0.3%	826	0.3%	800	0.2%	-4.9%
Nevada							
Total	398,000	100.0%	620,000	100.0%	923,000	100.0%	131.9%
Total Private	341,000	85.7%	544,000	87.7%	813,000	88.1%	138.4%
Mining	6,220	1.6%	14,300	2.3%	13,200	1.4%	112.2%
Metal Mining	3,640	0.9%	13,000	2.1%	11,500	1.2%	215.9%
Nonmetallic minerals	1,770	0.4%	1,130	0.2%	1,670	0.2%	-5.7%
New Mexico							
Total	444,000	100.0%	561,000	100.0%	693,000	100.0%	56.1%
Total Private	335,000	75.5%	430,000	76.6%	543,000	78.4%	62.1%
Mining	29,460	6.6%	16,100	2.9%	15,000	2.2%	-49.1%
Metal Mining	10,700	2.4%	2,120	0.4%	2,000	0.3%	-81.3%
Nonmetallic minerals	3,400	0.8%	2,310	0.4%	1,650	0.2%	-51.5%

Table G-3. Employment Trends in Study Area, 1980-1998

State	1980	Percent of 1980 Total	1990	Percent of 1990 Total	1998	Percent of 1998 Total	Percent Change 1980-1998
Oregon							
Total	1,020,000	100.0%	1,240,000	100.0%	1,550,000	100.0%	52.0%
Total Private	824,000	80.8%	1,030,000	83.1%	1,320,000	85.2%	60.2%
Mining	2,280	0.2%	1,530	0.1%	1,810	0.1%	-20.6%
Metal Mining	271	0.0%	106	0.0%	0	N/A	N/A
Nonmetallic minerals	1,620	0.2%	1,300	0.1%	1,770	0.1%	9.3%
Utah							
Total	523,000	100.0%	694,000	100.0%	992,000	100.0%	89.7%
Total Private	407,000	77.8%	553,000	79.7%	827,000	83.4%	103.2%
Mining	18,500	3.5%	0	0.0%	8,040	0.8%	-56.5%
Metal Mining	8,430	1.6%	3,090	0.4%	2,560	0.3%	-69.6%
Nonmetallic minerals	999	0.2%	0	0.0%	1,030	0.1%	3.1%
Washington							
Total	1,600,000	100.0%	2,140,000	100.0%	2,590,000	100.0%	61.9%
Total Private	1,290,000	80.6%	1,760,000	82.2%	2,150,000	83.0%	66.7%
Mining	3,160	0.2%	0	N/A	3,250	0.1%	2.8%
Metal Mining	869	0.1%	963	0.0%	348	0.0%	-60.0%
Nonmetallic minerals	1,580	0.1%	1,650	0.1%	2,320	0.1%	46.8%
Wyoming							
Total	205,000	100.0%	191,000	100.0%	220,000	100.0%	7.3%
Total Private	163,000	79.5%	140,000	73.3%	167,000	75.9%	2.5%
Mining	36,000	17.6%	18,300	9.6%	16,600	7.5%	-53.9%
Metal Mining	6,430	3.1%	760	0.4%	690	0.3%	-89.3%
Nonmetallic minerals	5,690	2.8%	3,920	2.1%	3,130	1.4%	-45.0%
Study Area Total							
Total	17,000,000	100.0%	22,300,000	100.0%	26,226,000	100.0%	54.3%
Total Private	14,000,000	82.4%	18,700,000	83.9%	22,144,000	84.4%	58.2%
Mining	207,000	1.2%	138,200	0.6%	124,960	0.5%	-39.6%
Metal Mining	64,700	0.4%	40,300	0.2%	36,458	0.1%	-43.7%
Nonmetallic minerals	25,900	0.2%	20,000	0.1%	21,530	0.1%	-16.9%
U.S. Total							
Total	89,200,000	100.0%	109,000,000	100.0%	124,000,000	100.0%	39.0%
Total Private	73,400,000	82.3%	90,900,000	83.4%	105,000,000	84.7%	43.1%
Mining	10,400,002	11.7%	711,000	0.7%	588,000	0.5%	-94.3%
Metal Mining	100,000	0.1%	58,900	0.1%	48,800	0.0%	-51.2%
Nonmetallic minerals	124,000	0.1%	112,000	0.1%	110,000	0.1%	-11.3%
Study Area as Percent of U.S.							
Total	19.1%		20.5%		21.2%		
Total Private	19.1%		20.6%		21.1%		
Mining	2.0%		19.4%		21.3%		
Metal Mining	64.7%		68.4%		74.7%		
Nonmetallic minerals	20.9%		17.9%		19.6%		

Notes: Figures rounded to three significant digits. "0" shows data that were withheld to avoid disclosure of proprietary information.
N/A = not applicable.
Source: Bell 2000.

METHODOLOGY FOR ESTIMATING THE CONTRIBUTION OF LOCATABLE MINERAL PRODUCTION TO THE ECONOMIES OF THE 12 WESTERN STATES

Introduction

This analysis provides baseline estimates of the regional economic impacts of locatable mineral production in the western United States under current conditions. The estimates are based on estimated values of mine production and use of the U.S. Forest Service IMPLAN (IMpact analysis for PLANning) model. The IMPLAN model estimates the direct, indirect, and induced impacts of an economic activity on a defined region. This appendix presents the following:

- A general overview of regional input-output (I-O) modeling along with limitations of the methodology.
- Some results of previous regional economic analyses for energy and minerals as a basis for comparison with the analysis presented here.
- U.S. Department of Commerce data, which may provide some basis for potentially varying production functions and rates of return for mining operations in various states.

This appendix also estimates the multipliers and regional impacts from production of locatable minerals.

Estimating Regional Impacts

Regional impacts represent the effect, typically measured by the value of total output and income, of an activity on the local economy. Regional impacts can be distinguished by direct effects, indirect effects, and induced effects. Direct effects are represented by changes in the value of production in the original final demand industry. Indirect effects are backward linkages, where production is needed from industries supplying the original industry. These backward linkages can continue for several rounds and provide other economic impacts to the region. Induced effects are changes in regional household spending caused by regional employment changes. These changes in employment and income result from direct and indirect effects. The combination of direct, indirect, and induced effects result in multiplier effects from economic activities within a region.

The IMPLAN model uses the U.S. Department of Commerce national I-O model to estimate the flows of commodities used and produced by industry. The social accounts of the region under consideration are also included in the IMPLAN data base. Social accounts represent the flow of commodities to industry from producers and consumers as well as consumption of the factors of production from outside the region. Social accounts are converted to the input/output accounts and multipliers for each industry. IMPLAN includes tables that account for the percentage of each category's expenditures that remain within the region and expenditures that would flow outside the region.

Assumptions used in the I-O based regional impact models can potentially limit the accuracy of some basic models. The inputs used by every firm and the outputs produced by every firm in an industry are assumed to be used or produced in the same proportions. The assumption of homogeneous production can be a problem if production techniques greatly vary within the same industry.

The level of output for any industry is also assumed to be the only factor that determines input purchase requirements. Changes in the relative prices of inputs that would affect the mix of inputs purchased are not accounted for. Changes in technology are not accounted for unless the production functions are modified over time and the models are rerun after each change. Constant returns to scale are assumed, where production functions are linear, the effects of increased demand are additive, and the distribution of purchases and sales is assumed to be static.

I-O models represent the current relationships among production, technology, market structures, and inter-regional trade. Because these relationships are assumed to be static, substitutions between inputs are not allowed. One major reason that substitution would be expected consists of changes in input prices. If the relative prices for inputs change, input substitution would be expected to occur because a different mix of inputs may become more cost effective. Changes in output prices can also cause substitution effects that would reduce total regional impacts. But substitution is not allowed within the I-O model. In addition, the supply of all inputs required for current and future production is not considered to be a constraint in an I-O model.

In the short run these limitations in the I-O methodology may not create significant problems because of the relatively limited adjustments that can be made in a short time. Input substitutions may not be possible immediately, so price changes may not have a short-run impact on the types of inputs used. In the long run, however, an I-O based analysis may not reliably estimate regional impacts. The longer period of time allows producers to respond to price changes, and technology can change substantially in the long run. These factors allow for greater substitution in the long run and a greater possibility of error in a static I-O based model.

The problems of I-O based analyses may also be minor if the impact region is not large enough to significantly affect the market and, therefore, significantly affect prices of inputs and outputs. A small-market impact results in minor price effects and, therefore, minor substitution effects. If a large region is included in an analysis, price effects are more likely, and the input-output analysis will miss some substitution effects.

Estimating the regional impacts from changes in mineral production using IMPLAN may result in significant errors due to the problems mentioned above. Mining techniques for the same mineral can vary a great deal in different regions, resulting in varied input requirements. Input and output prices in the mineral industry can also fluctuate significantly over a relatively short period. Despite these potential problems, an analysis of mineral extraction impacts using IMPLAN reveals the magnitude of mineral production impacts.

Types of Multipliers

Output multipliers translate the impact of changes in final demand spending into changes in output. ***Total industry output*** is the value of sales, in producer prices, from industry production. Final demand reflects the value of all commodities and services purchased for final use. Final demand is equal to the sum of household purchases, government purchases, business investment purchases, exports, and inventory sales. Payments between governmental units are considered transfer payments and are excluded from this measure. Exports include purchases of goods or services that are exported from the region.

Total income multipliers translate the impact of changes in final demand spending into changes in total income. Total income is defined as the sum of changes in employee compensation, proprietary income, and other property income, resulting from a change in final demand. Total income is equal to property income plus employee compensation. Property income includes proprietary income and other property income. Proprietary income can be defined as all income from self-employment, such as income earned by noncorporate business owners, doctors, and lawyers. Other property income includes dividends, interest, royalties, rental income, corporate profits, and corporate transfer payments. ***Employee compensation,*** a subcategory of total income, represents worker income as measured by wages, salaries, benefits, and retirement payments.

Value added multipliers translate the impact of changes in final demand spending into changes in value added. Value added represents income generated by local factors of production and payments to government, including employee compensation, proprietary income, other types of property income, and indirect business taxes. Indirect business taxes are payments to government on production, sales, purchase, or use of goods and services. Indirect business taxes do not include taxes on profit or income.

Employment multipliers are based on the fact that a change in final demand will have direct, indirect, and induced effects that will lead to employment changes. Employment multipliers measure the total change in employment from the production of $1 of output for final demand. Employment is measured by both part- and full-time jobs. Therefore, the number of jobs does not consist of full-time equivalents.

The extent of regional impacts can be measured in IMPLAN by two types of multipliers. Type I multipliers measure the sum of the direct plus indirect effects divided by the direct effects, or Type I multiplier = (Direct + Indirect)/(Direct). Type III multipliers account for induced effects, where: Type III multiplier = (Direct + Indirect + Induced)/(Direct). The induced effects in Type III multipliers are derived from an open model where households are exogenous or "outside" the model. The open model allows the assumption that some household spending occurs outside the region of consideration.

A large multiplier generally means that an industry is closely linked to the local economy. But if the industry is small relative to the size of the local economy, then a big multiplier does not translate into a large stimulus. But a small increase in demand for a sector with a small multiplier can have a significant impact if that industry produces a large proportion of total output of the

regional economy. Also, if the direct effect is tiny compared to the calculated indirect and induced effects, then dividing the difect effect into indirect or the sum of indirect and induced effects will result in a large number. In these cases the large multiplier is not meaningful and should be ignored.

The Value of Mineral Production, Costs of Production, and Profits

Current information on the costs of mineral production, profits or value added from production, and the variation from region to region can provide some basis for evaluating the overall importance of locatable minerals in each region and how average production relationships apply to specific regions. The rates of return for mining operations have varied a great deal over the last 10 years. According to the U.S. Department of Commerce, Bureau of the Census, the average rate of return for all mining operations with assets of $50 million or more from the fourth quarter of 1987 to the first quarter of 1996 was 5.05 cents per dollar investment before taxes and 3.54 cents after taxes (Bureau of the Census 1997). The rate of return over the 10-year period has ranged from -7.4 cents to 14.1 cents per dollar after taxes. The rate of return for mineral extraction investment is fairly low, but this does not say that the regional impacts from mineral production are small.

Mineral production requires large amounts of investment, which supports industries providing production inputs. Tables G-4 and G-5 show the value of inputs and value added for mineral industries by state and as a national average from the 1992 Census of Mineral Industries. Although the data are not complete, they do show the relative costs of labor, supplies, and capital for different types of operations. This information is useful for modifying production relationships in the IMPLAN model.

Recent Mineral Impact Studies

A recent study of the U.S. gold industry estimated the regional impacts from gold and silver production at the state level (Dobra 1999). The Dobra study included estimates of the total value of gold and silver production as well as employment, output, and earnings impacts in 1997. The results for states in the study area are presented in Table G-6.

The Dobra study used production estimates provided by individual state geology agencies or the U.S. Geological Survey, London gold and silver prices, and U.S. Bureau of Economic Analysis impact multipliers. The important result of the study is the large regional impacts of gold production in the western states.

Another study of regional impacts of restraints to mineral access in the East Mojave National Scenic Area estimated the potential impacts to industry output, earnings, and employment in San Bernardino County, California, from mine construction and production (Schantz and Adams 1990). The East Mojave study showed impacts of about $1.27 billion from cumulative gold mine revenues of $968 million at the county level. These amounts represent substantial impacts considering the small study area.

Another study, published by the National Mining Association (see Table G-7), estimated the economic impact of the solid-minerals mining industry (Leaming 1997). This study, which included minerals such as coal and many nonlocatable types, estimated that the western states generated $115 billion and 1.1 million jobs in 1995. These figures amount to 37% of the $524 billion total U.S. impact of solid-mineral mining and 22% of the estimated 5 million total jobs. The data and methodology used in this study differ substantially from the multiplier analyses described previously, and the figures cannot be compared between the studies. This study, nevertheless, provides a useful comparison of the western mining industry in relation to the national industry as a whole.

A U.S. Forest Service analysis of energy and minerals industries in the United States provided information on the economic contribution of U.S. extractive industries at the state, regional, and national levels (USFS 1996). This study estimated multipliers for metallic ores, including copper, gold, silver, ferroalloy ores, uranium, radium, and other metal ores not classified elsewhere. The study also estimated multipliers for metal mining services, describing in detail mineral industry impacts. This study can be used to help validate the regional economic impacts presented in this analysis. The Forest Service analysis estimated multipliers for 1977, 1982, 1985, and 1990 for the Nation, for each Resource Planning Act region in the United States, and for individual states. State-level multipliers are presented for 1985 and 1990 in Tables G-8 and G-9.

The Forest Service analysis also presented base year statistics that estimate the regional impacts from extraction industries. These results showed significant impacts from mineral and energy industry activities. But the importance of metal mining in the United States appeared to have decreased slightly from 1977 to 1990. The decrease in the importance of metal mining was not universal. Metal mining increased in importance in Nevada from 0.52% of nominal gross state product in 1977 to 6.12% of nominal gross state product in 1990.

Table G-4. Employment, Payroll, Value Added, and Costs of Production for Mining (million $)						
State/type of mining	Establis h-ments	Total Employees	Payroll	Value Added by Mining	Cost of Supplies	Capital Expenditures
Alaska						
Lead and zinc ores	2	250-499	-	-	-	-
Gold	41	400	$19.0	$129.4	-	-
Arizona						
Copper ores	28	10,100	384.6	1,429.9	$888.9	$187.2
Gold ores	28	300	11.3	48.1	-	-
Silver ores	1	<199	-	-	-	-
Metal mining services	27	500	15.1	42.2	17.9	5.0
California						
Gold ore	45	2,100	77.3	267.7	-	-
Miscellaneous metal ores	11	250-499	-	-	-	-
Colorado	5	-	-	-	-	-
Lead and zinc ores	52	1,200	88.7	4.8	-	-
Gold ores	1	-	-	-	-	-
Silver ores	20	200	7.0	12.2	4.3	1.2
Metal mining services	5	100-249	-	-	-	-
Idaho	25	250-499	-	-	-	-
Lead and zinc ores	9	250-499	-	-	-	-
Gold ores	4	250-499	-	-	-	-
Silver ores	3	500-999	-	-	-	-
Miscellaneous metal ores	21	1000	36.8	160.6	60.9	31.6
Montana	16	200	6.3	15.0	-	-
Copper ores	7	250-499	-	-	-	-
Gold and silver ores	119	9,900	455.1	1,718.0	1,096.2	556.1
Metal mining services	36	1,100	40.6	106.4	-	-
Miscellaneous metal ores	7	1000-2499	-	-	-	-
Nevada	5	1000-2499	-	-	-	-
Gold and silver ores	23	500	20.2	79.3		-
Metal mining services	22	400	16.4	14.2	-	-
New Mexico	11	100-249	-	-	-	-
Copper ores	13	500	23.5	67.2	-	-
Gold and silver ores	14	100	4.9	8.8	-	-
Metal mining services	15	300	$15.3	$14.5	-	-
Miscellaneous metal ores						
Utah						
Copper ores						
Gold and silver ores						
Metal mining services						
Miscellaneous metal ores						
Washington						
Gold and silver ores						
Metal mining services						
Wyoming						
Miscellaneous metal ores						

Source: Bureau of the Census 1996a,b.

Table G-5. National Average Costs of Production for Various Minerals, 1992 (million $)

Item	Copper	Gold	Metal Mining Services	Miscellaneous Metal Ores	Silver
Supplemental labor costs	$136.7	$181.2	$29.9	$24.7	$16.7
Purchased fuels consumed	61.4	108.9	16.2	8.8	4.5
Purchased electricity	316.7	143.9	2.2	29.5	4.5
Contract work	113.7	-	-	-	-
Minerals/ores for preparation	208.3	NA	NA	1.6	NA
Purchased machinery	370.5	362.1	13.1	9.5	-
Parts and attachments	146.9	147.1	8.7	13.0	-
Industrial chemicals	104.1	128.3	NA	13.6	-
Explosive materials	37.4	61.6	-	3.2	-
Tires and inner tubes	39.9	39.0	-	0.8	-
Lime	21.8	26.3	-	1.2	-
Iron & steel castings and forgings	79.5	37.1	-	-	-
Steel shapes and forms	43.5	34.9	-	3.7	-
Other supplies	175.5	196.1	23.8	19.6	-
Undistributed	2.5	21.2	23.0	9.8	-
Communication services	1.7	3.3	0.8	0.4	0.1
Value of shipments and receipts	3,374.9	4,340.0	350.4	312.2	114.6
Change in inventories 1991-1992	21.6	18.4	3.2	-14.7	-10.9
New capital expend, buildings	-	538.2	0.4	5.0	-
New capital expend, equipment	385.8	103.8	16.5	14.4	-
Used capital expenditures	8.6	16.4	-	-	0.1
Mineral exploration/development	-	335.3	NA	-	5.0
Rental payments	$18.4	23.6	$6.9	$2.0	-
Lease rents	-	$10.1	NA	-	$0.1

Source: Bureau of the Census 1996c and 1996d.

Table G-6. Impacts of U.S. Gold and Silver Production, 1997 ($000)

State	Total value	Employment (jobs)	Output	Earnings
Alaska	$266,198	3,700	$471,809	$135,841
Arizona	2,876	91	7,051	2,338
California	259,069	4,793	531,300	146,271
Colorado	76,197	2,758	200,786	53,041
Idaho	139,921	3,092	254,167	74,228
Montana	110,384	2,782	223,163	64,508
Nevada	2,722,650	51,730	4,858,025	1,493,101
Utah	$278,910	9,148	$734,231	$217,048

Source: Dobra 1999.

Table G-7. Economic Impact of Solid-Mineral Mining from NMA Study ($000)			
State	**Total Value of Solid Minerals Produced**	**Total Economic Impact**	**Total Employment**
Alaska	$589,600	$1,342,600	12,000
Arizona	4,975,800	13,715,900	137,300
California	2,866,100	52,475,900	469,200
Colorado	995,500	7,634,600	77,300
Idaho	383,300	1,898,300	23,600
Montana	1,049,400	2,214,100	24,900
Nevada	3,291,300	7,067,000	63,000
New Mexico	1,775,300	3,409,000	44,000
Oregon	391,600	5,108,300	53,500
Utah	2,417,000	6,907,000	66,200
Washington	730,300	9,604,800	92,300
Wyoming	2,695,500	3,967,400	41,400
12-State Total	22,160,700	115,344,900	1,104,700
U.S. Total	$60,055,000	$523,604,100	4,954,000
Western Region as Percent of U.S.	37%	22%	22%
Source: Leaming 1997.			

Multipliers and Regional Impacts from Locatable Mineral Production

The IMPLAN model was used along with estimates of the value of locatable mineral production at the state level to estimate regional impacts. The categories of minerals include gold, silver, copper, and other metals and industrials. The regional impacts for the "other metals and industrials" category were estimated using the metal mining services and other metals sectors. The types of mining operations in the West greatly vary, and the input requirements can vary a great deal. This variation will affect the estimated multipliers. The multipliers estimated using the IMPLAN model are based on national-level production relationships. The multipliers and regional impact analysis can be improved by adjusting the input requirements for different types of operations.

The production function coefficients can be modified in IMPLAN to account for regional production differences. These modifications require detailed input requirement data from which production relationships can be estimated. Detailed input requirement data are not available from a cross-section of mining operations at a small regional level. But Bureau of the Census data, such as in Tables G-4 and G-5, can be used to estimate the percentage of total production costs attributable to labor and capital expenditures. These percentages, on a statewide basis, can be compared to the national average and used to modify the labor and capital percentages represented in the IMPLAN model.

The U.S. Department of Commerce mining cost data for employee payroll and capital expenditures for each of the 12 states and the study area total were compared to the national

Table G-8. 1985 Multipliers Derived in the Forest Service Analysis								
State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Metallic Ores	1.28	1.44	1.64	2.06	1.44	1.71	1.27	1.52
Metal mining services	1.23	1.46	1.41	1.87	1.32	1.65	1.14	1.35
Arizona								
Metallic Ores	1.40	1.68	1.69	2.27	1.62	2.13	1.40	1.79
Metal mining services	1.28	1.49	1.53	1.99	1.29	1.54	1.39	1.78
Idaho								
Metallic Ores	1.24	1.61	1.34	1.89	1.32	1.85	1.26	1.82
Metal mining services	1.22	1.63	1.30	1.88	1.27	1.82	1.21	1.74
Montana								
Metallic Ores	1.45	2.10	2.09	3.95	1.66	2.72	1.47	2.50
Metal mining services	1.34	1.93	1.61	2.75	1.40	2.12	1.38	2.36
Nevada								
Metallic Ores	1.47	2.01	1.77	2.77	1.76	2.74	1.49	2.24
Metal mining services	1.36	1.89	1.43	2.11	1.44	2.12	1.36	2.05
New Mexico								
Metallic Ores	1.43	1.86	1.65	2.38	1.56	2.19	1.45	2.16
Metal mining services	1.39	2.02	1.83	3.24	1.50	2.36	1.27	1.89
Utah								
Metallic Ores	1.46	1.81	1.75	2.41	1.65	2.21	1.48	2.06
Metal mining services	1.31	1.61	1.47	1.94	1.33	1.65	1.41	1.96
Wyoming								
Metallic Ores	1.28	1.56	1.52	2.07	1.36	1.74	1.25	1.68
Metal mining services	1.24	1.47	1.39	1.76	1.27	1.53	1.27	1.71
Pacific Region (CA, OR, WA)								
Metallic Ores	1.58	2.31	2.08	4.32	1.99	4.05	1.39	2.34
Source: USFS 1996.								

Table G-9. 1990 Multipliers Derived in the Forest Service Analysis								
State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Metallic Ores	1.16	1.22	1.22	1.31	1.19	1.26	1.39	1.70
Metal mining services	1.14	1.25	1.18	1.35	1.14	1.27	1.15	1.40
Arizona								
Metallic Ores	1.54	1.76	2.43	3.24	2.48	3.36	2.50	3.85
Metal mining services	1.27	1.67	1.29	1.77	1.28	1.75	1.30	2.02
Idaho								
Metallic Ores	1.33	1.56	1.47	1.80	1.46	1.78	1.92	3.00
Metal mining services	1.27	1.64	1.31	1.74	1.29	1.70	1.37	2.17
Montana								
Metallic Ores	1.40	1.67	1.61	2.08	1.55	1.96	2.00	3.31
Metal mining services	1.26	1.63	1.30	1.77	1.25	1.63	1.37	2.28
Nevada								
Metallic Ores	1.37	1.62	1.49	1.82	1.50	1.85	1.82	2.69
Metal mining services	1.32	1.70	1.36	1.81	1.36	1.82	1.34	1.99
New Mexico								
Metallic Ores	1.56	1.78	2.35	3.06	2.29	2.99	2.56	4.07
Metal mining services	1.33	1.77	1.38	1.94	1.34	1.86	1.34	2.15
Utah								
Metallic Ores	1.55	1.77	2.18	2.78	2.15	2.74	2.52	3.84
Metal mining services	1.30	1.66	1.32	1.73	1.30	1.67	1.36	2.10
Wyoming								
Metallic Ores	1.19	1.37	1.19	1.40	1.18	1.36	1.25	1.72
Metal mining services	1.20	1.38	1.20	1.41	1.18	1.37	1.24	1.71
Pacific Region (CA, OR, WA)								
Metallic Ores	1.45	1.88	1.57	2.14	1.59	2.19	1.97	3.43
Source: USFS 1996.								

average. These percentages were then applied to the national average employee compensation and capital equipment categories included in the IMPLAN model. The new coefficients were then applied to the individual states. In most cases the differences were less than a 10% change in the coefficient, but the change was important enough to merit the modification.

Although this method for modifying the production functions is not precise, it does attempt to account for regional differences in mineral production. Any evaluation of surface mining regulation alternatives will use a consistent methodology so the economic impacts of the alternatives can be compared on an equal basis. The multipliers for locatable minerals in the study area are presented by state and type of mineral in Table G-10.

The regional impacts from locatable mineral production are based on the estimated value of production adjusted for the local level of activity using IMPLAN local purchase coefficients (LPCs). These LPCs show the percentage of regional demand that can be met by local sources and represent the proportion of activity that occurs in the model region. Using the LPCs better represents the true impact of the mining on the region because the need for some imports is recognized. Assuming all regional demand can be met locally would overstate the regional economic impacts.

The mineral production values used to estimate the regional impacts are presented in Table G-11. These figures represent the portion of mine production of locatable minerals estimated to originate only from public lands in the study area.

The estimated regional impacts from the production of locatable minerals on public lands in the study area are presented in Table G-12. The impacts presented here are based on average production relationships at the national level. Therefore, the estimates are representative of the magnitude of the impacts rather than precise estimates.

The study-area total listed in Table G-12 is not a summation of the impacts estimated for each state. The study area represents a separate IMPLAN impact area. The expenditure and income leakages from the aggregate 12-state area would not be the same as the sum of leakages for each state. Since the larger area would be expected to have relatively small leakages, the overall economic impact of mineral production from a 12-state perspective would be expected to be larger than shown by the individual states.

In comparison, Table G-13 shows the regional economic impacts of all locatable-type mineral production in the study area regardless of land ownership (i.e. including production originating from federal, state, and private lands).

Tables G-14 through G-16 show the regional economic impacts by alternative for Alternatives 2, 3, 4, and 5. See the Economics section in Chapter 3 for an explanation of these impacts.

Table G-10. Estimated 1994 Multipliers

State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Alaska								
Gold	1.32	1.45	1.40	1.60	1.35	1.53	1.63	2.13
Silver	1.10	1.37	1.09	1.35	1.07	1.28	1.08	1.43
Other	1.12	1.25	1.13	1.30	1.12	1.26	1.19	1.56
Arizona								
Gold	1.34	1.62	1.39	1.77	1.37	1.71	1.68	2.64
Silver	1.00	1.57	1.00	1.42	1.00	1.36	1.00	1.59
Copper	1.29	1.56	1.31	1.63	1.30	1.60	1.62	2.55
Other	1.19	1.66	1.23	1.89	1.21	1.79	1.16	1.85
California								
Gold	1.37	1.70	1.36	1.71	1.36	1.73	1.58	2.51
Silver	1.10	1.86	1.07	1.63	1.07	1.61	1.05	1.69
Copper	1.30	1.68	1.27	1.64	1.28	1.66	1.39	2.21
Other	1.10	1.37	1.08	1.29	1.08	1.30	1.17	1.86
Colorado								
Gold	1.43	1.67	1.46	1.74	1.43	1.68	2.14	3.41
Silver	1.12	1.76	1.09	1.62	1.08	1.52	1.07	1.74
Copper	1.36	1.60	1.36	1.60	1.34	1.57	1.96	3.13
Other	1.15	1.37	1.13	1.34	1.12	1.31	1.31	2.09
Idaho								
Gold	1.29	1.50	1.27	1.47	1.26	1.47	1.63	2.54
Silver	1.21	1.62	1.20	1.64	1.17	1.55	1.23	1.95
Copper	1.20	1.40	1.17	1.34	1.17	1.35	1.50	2.34
Other	1.17	1.57	1.14	1.49	1.13	1.46	1.19	1.88
Montana								
Gold	1.37	1.57	1.37	1.61	1.33	1.54	1.83	2.93
Silver	1.11	1.25	1.09	1.23	1.07	1.16	1.27	2.03
Copper	1.31	1.53	1.28	1.51	1.27	1.48	1.61	2.58
Other	1.11	1.29	1.08	1.26	1.07	1.22	1.22	1.94

Table G-10. Estimated 1994 Multipliers (cont.)

State or Region	Output		Total Income		Value Added		Employment	
	Type I	Type III	Type I	Type III	Type I	Type III	Type I	Type III
Gold	1.14	1.60	1.48	1.73	1.47	1.74	1.75	2.42
Silver	1.04	1.39	1.03	1.26	1.03	1.26	1.03	1.45
Copper	1.37	1.63	1.43	1.76	1.44	1.79	1.48	2.08
Other	1.01	1.28	1.01	1.17	1.01	1.18	1.01	1.42
New Mexico								
Gold	1.52	1.71	1.77	2.15	1.58	1.84	2.98	4.65
Silver	1.24	1.46	1.29	1.62	1.18	1.38	1.49	2.33
Copper	150	1.79	1.78	2.31	1.65	2.09	1.94	3.02
Other	1.24	1.62	1.36	2.03	1.27	1.78	1.25	1.98
Oregon								
Gold	1.11	1.37	1.08	1.28	1.08	1.27	1.20	1.98
Copper	1.07	1.30	1.05	1.20	1.05	1.20	1.14	1.89
Other	1.20	1.71	1.26	1.96	1.22	1.82	1.19	1.99
Utah								
Gold	1.40	1.64	1.53	1.90	1.46	1.77	2.04	3.17
Silver	1.15	1.44	1.12	1.40	1.09	1.31	1.19	1.85
Copper	1.38	1.63	1.46	1.82	1.42	1.75	1.83	2.85
Other	1.20	1.45	1.22	1.53	1.19	1.46	1.34	2.08
Washington								
Gold	1.24	1.47	1.20	1.39	1.20	1.40	1.51	2.43
Silver	1.09	1.55	1.06	1.41	1.06	1.37	1.08	1.77
Copper	1.20	1.48	1.15	1.36	1.15	1.38	1.32	2.13
Other	1.05	1.50	1.03	1.32	1.03	1.32	1.04	1.71
Wyoming								
Other	1.18	1.32	1.25	1.46	1.20	1.36	1.49	2.15
12-State Total								
Gold	1.59	1.97	1.70	2.22	1.68	2.19	2.11	3.44
Silver	1.11	1.67	1.07	1.49	1.07	1.45	1.08	1.80
Copper	1.49	1.87	1.58	2.09	1.53	2.00	1.84	3.00
Other	1.19	1.50	1.19	1.54	1.17	1.47	1.32	2.15

Source: USFS 1996.

Table G-11. Value of Locatable Mineral Production Originating from Federal Lands 1998 ($000)

Portion of study-area production originating from public lands[1]	43.4%	36.2%	1.0%	2.4%	N/A
State	**Gold**	**Silver**	**Copper**	**Other Metals and Industrials**	**Total**
Alaska	$75,500	$26,600	$0	$16,100	$118,000
Arizona	7,550	12,600	20,600	9,140	49,900
California	76,800	673	0	19,600	97,100
Colorado	31,700	825	0	7,460	40,000
Idaho	23,000	26,500	0	5,830	55,300
Montana	33,800	4,560	820	6,710	45,900
Nevada	1,120,000	39,800	1,170	4,920	1,170,000
New Mexico	11,700	1,200	4,380	8,290	25,600
Oregon	0	0	0	2,010	2,010
Utah	47,700	6,910	4,880	10,800	70,300
Washington	14,600	37	0	3,730	18,300
Wyoming	0	0	0	5,240	5,240
Study-Area Total	1,440,000	120,000	31,900	99,800	1,700,000
U.S. Total (all land types)	$3,480,000	$339,000	$3,220,000	$8,920,000	$16,000,000
Federal Land Portion as Percent of U.S. Total	42%	35%	1%	1%	11%

[1]Source: USDI 1993.
N/A = not applicable. Figures rounded to three significant digits. Some totals may reflect rounding errors.
Note: Includes all production from federal lands, not just production from BLM-administered lands.

Table G-12. Estimated Regional Impacts from Production of Locatable Minerals on Public Lands 1998 ($000)

State	Total Industry Output	Personal Income		Value Added	Employment (jobs)
		Total	Employee Compensation		
Alaska	$143,800	$65,900	$30,500	$83,800	970
Arizona	40,600	20,500	12,200	24,100	320
California	142,400	76,500	46,500	83,800	1,020
Colorado	57,600	28,400	16,300	33,800	350
Idaho	69,400	35,300	20,700	41,800	680
Montana	61,700	29,300	18,200	37,600	410
Nevada	1,808,700	829,500	466,300	907,600	10,740
New Mexico	32,000	12,000	5,500	16,600	220
Oregon	1,250	500	900	1,000	10
Utah	14,920	20,900	11,100	25,700	360
Washington	19,900	11,900	7,600	13,300	130
Wyoming	3,500	1,800	900	2,500	30
12-State Area	$3,076,800	$1,390,500	$766,000	$1,588,400	21,310

Note: These estimates include **only** production estimated to originate from federal lands.
Source: IMPLAN Input-Output Modeling System.

Table G-13: Estimated Regional Impacts from Production of Locatable Minerals 1998–All Land Ownerships ($000)

State	Total Industry Output	Personal Income		Value Added	Employment (jobs)
		Total	Employee Compensation		
Alaska	$757,200	$428,700	$201,400	$540,300	6,800
Arizona	3,401,700	1,688,500	998,700	1,965,400	25,600
California	849,400	557,900	327,000	614,600	8,600
Colorado	328,500	203,000	12,000	242,000	2,600
Idaho	346,800	185,600	96,100	219,700	3,900
Montana	430,400	235,300	141,300	301,600	3,500
Nevada	4,347,800	2,044,800	1,158,500	2,236,300	26,400
New Mexico	862,000	346,300	165,900	458,700	7,400
Oregon	52,900	38,500	22,300	43,100	350
Utah	1,163,300	540,700	286,700	653,700	9,400
Washington	127,200	85,500	51,700	97,700	1,200
Wyoming	147,100	75,600	36,800	103,200	1,350
Study Area	$15,672,800	$7,778,300	$4,358,500	$9,006,000	118,750

Table G-14. Alternative 2 (State Management) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	$118,000	$124,000	$144,000	$151,000	$65,900	$69,200	$30,500	$32,000	$83,800
Arizona	49,900	52,300	40,600	42,600	20,500	21,500	12,200	12,800	24,100
California	97,100	102,000	142,000	150,000	76,500	80,300	46,500	48,800	83,800
Colorado	40,000	42,000	57,600	60,500	28,400	29,800	16,300	17,100	33,800
Idaho	55,300	58,100	69,400	72,900	35,300	37,100	20,700	21,700	41,800
Montana	45,900	48,200	61,700	64,800	29,300	30,800	18,200	19,100	37,600
Nevada	1,170,000	1,230,000	1,810,000	1,900,000	830,000	871,000	466,000	490,000	908,000
New Mexico	25,600	26,900	32,000	33,600	12,000	12,600	5,500	5,780	16,600
Oregon	2,010	2,110	1,250	1,310	500	525	900	945	1,000
Utah	70,300	73,900	49,200	51,700	20,900	21,900	11,100	11,700	25,700
Washington	18,300	19,300	19,900	20,900	11,900	12,500	7,600	7,980	13,300
Wyoming	5,240	5,510	3,500	3,680	1,800	1,890	900	945	2,500
Study-Area Total	$1,700,000	$1,780,000	$3,080,000	$3,230,000	$1,390,000	$1,460,000	$766,000	$804,000	$1,590,000

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	$0	$5,910	$0	$7,190	$0	$3,300	$0	$1,530	$0
Arizona	0	2,490	0	2,030	0	1,030	0	610	0
California	0	4,850	0	7,120	0	3,830	0	2,330	0
Colorado	0	2,000	0	2,880	0	1,420	0	815	0
Idaho	0	2,770	0	3,470	0	1,770	0	1,040	0
Montana	0	2,300	0	3,090	0	1,470	0	910	0
Nevada	0	58,500	0	90,400	0	41,500	0	23,300	0
New Mexico	0	1,280	0	1,600	0	600	0	275	0
Oregon	0	101	0	63	0	25	0	45	0
Utah	0	3,520	0	2,460	0	1,050	0	555	0
Washington	0	917	0	995	0	595	0	380	0
Wyoming	0	262	0	175	0	90	0	45	0
Study Area Total	$0	84,900	$0	$154,000	$0	$69,500	$0	$38,300	$0

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling Syste

Table G-15. Alternative 3 (Proposed Action) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	$106,000	$94,600	$129,000	$115,000	$59,300	$52,700	$27,500	$24,400	$75,400
Arizona	44,900	34,900	36,500	28,400	18,500	14,400	11,000	8,540	21,700
California	87,400	72,800	128,000	107,000	68,900	57,400	41,900	34,900	75,400
Colorado	36,000	28,000	51,800	40,300	25,600	19,900	14,700	11,400	30,400
Idaho	49,800	44,300	62,500	55,500	31,800	28,200	18,600	16,600	37,600
Montana	41,300	32,100	55,500	43,200	26,400	20,500	16,400	12,700	33,800
Nevada	1,050,000	819,000	1,630,000	1,270,000	747,000	581,000	420,000	326,000	817,000
New Mexico	23,000	17,900	28,800	22,400	10,800	8,400	4,950	3,850	14,900
Oregon	1,910	1,710	1,190	1,060	475	425	855	765	950
Utah	63,300	49,200	44,300	34,400	18,800	14,600	9,990	7,770	23,100
Washington	17,400	14,700	18,900	15,900	11,300	9,520	7,220	6,080	12,600
Wyoming	4,980	4,460	3,330	2,980	1,710	1,530	855	765	2,380
Study-Area Total	$1,530,000	$1,210,000	$2,770,000	$2,200,000	$1,250,000	$994,000	$690,000	$548,000	$1,430,000

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	($11,800)	($23,600)	($14,400)	($28,800)	($6,950)	($13,200)	($3,050)	($6,100)	($8,380)
Arizona	(5,000)	(15,000)	(4,060)	(12,200)	(2,050)	(6,150)	(1,220)	(3,660)	(2,410)
California	(9,710)	(24,300)	(14,200)	(35,600)	(7,650)	(19,100)	(4,650)	(11,600)	(8,380)
Colorado	(4,000)	(12,000)	(5,760)	(17,300)	(2,840)	(8,520)	(1,630)	(4,890)	(3,380)
Idaho	(5,530)	(11,100)	(6,940)	(13,900)	(3,530)	(7,060)	(2,070)	(4,140)	(4,180)
Montana	(4,590)	(13,800)	(6,170)	(18,500)	(2,930)	(8,790)	(1,820)	(5,460)	(3,760)
Nevada	(117,000)	(351,000)	(181,000)	(543,000)	(83,000)	(249,000)	(46,600)	(140,000)	(90,800)
New Mexico	(2,560)	(7,670)	(3,200)	(9,600)	(1,200)	(3,600)	(550)	(1,650)	(1,660)
Oregon	(101)	(302)	(63)	(188)	(25)	(75)	(45)	(135)	(50)
Utah	(7,040)	(21,100)	(4,920)	(14,800)	(2,090)	(6,270)	(1,110)	(3,330)	(2,570)
Washington	(917)	(3,670)	(995)	(3,990)	(595)	(2,380)	(380)	(1,520)	(665)
Wyoming	(262)	(787)	(175)	(525)	(90)	(270)	(45)	(135)	(125)
Study Area Total	($169,000)	($484,000)	($305,000)	($877,000)	($138,000)	($396,000)	($75,800)	($218,000)	($157,000)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling Syste

Table G-16. Alternative 4 (Maximum Protection) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands ($000

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	$94,600	$82,700	$115,000	$101,000	$52,700	$46,100	$24,400	$21,400	$67,000
Arizona	24,900	12,500	20,300	10,200	10,300	5,130	6,100	3,050	12,100
California	68,000	48,500	99,700	71,200	53,600	38,300	32,600	23,300	58,700
Colorado	20,000	9,990	28,800	14,400	14,200	7,100	8,150	4,080	16,900
Idaho	41,500	33,200	52,000	41,600	26,500	21,200	15,500	12,400	31,400
Montana	22,900	11,500	30,900	15,400	14,700	7,330	9,100	4,550	18,800
Nevada	585,000	292,000	904,000	452,000	415,000	207,000	233,000	117,000	454,000
New Mexico	12,800	6,390	16,000	8,000	6,000	3,000	2,750	1,380	8,300
Oregon	1,810	1,610	1,130	1,000	450	400	810	720	900
Utah	35,200	17,600	24,600	12,300	10,500	5,230	5,550	2,780	12,900
Washington	13,800	11,000	14,900	11,900	8,930	7,140	5,700	4,560	9,980
Wyoming	4,720	4,200	3,150	2,800	1,620	1,440	810	720	2,250
Study-Area Total	$925,000	$532,000	$1,680,000	$963,000	$758,000	$435,000	$417,000	$240,000	$866,000

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	($23,600)	($35,500)	($28,800)	($43,100)	($13,200)	($19,800)	($6,100)	($9,150)	($16,800)
Arizona	(24,900)	(37,400)	(20,300)	(30,500)	(10,300)	(15,400)	(6,100)	(9,150)	(12,100)
California	(29,100)	(48,500)	(42,700)	(71,200)	(23,000)	(38,300)	(14,000)	(23,300)	(25,100)
Colorado	(20,000)	(30,000)	(28,800)	(43,200)	(14,200)	(21,300)	(8,150)	(12,200)	(16,900)
Idaho	(13,800)	(22,100)	(17,400)	(27,800)	(8,830)	(14,100)	(5,180)	(8,280)	(10,500)
Montana	(22,900)	(34,400)	(30,900)	(46,300)	(14,700)	(22,000)	(9,100)	(13,700)	(18,800)
Nevada	(585,000)	(877,000)	(904,000)	(1,360,000)	(415,000)	(622,000)	(233,000)	(350,000)	(454,000)
New Mexico	(12,800)	(19,200)	(16,000)	(24,000)	(6,000)	(9,000)	(2,750)	(4,130)	(8,300)
Oregon	(201)	(402)	(125)	(250)	(50)	(100)	(90)	(180)	(100)
Utah	(35,200)	(52,800)	(24,600)	(36,900)	(10,500)	(15,700)	(5,550)	(8,330)	(12,900)
Washington	(4,590)	(7,340)	(4,975)	(7,960)	(2,980)	(4,760)	(1,900)	(3,040)	(3,330)
Wyoming	(524)	(1,050)	(350)	(700)	(180)	(360)	(90)	(180)	(250)
Study Area Total	($773,000)	($1,170,000)	($1,400,000)	($2,110,000)	($633,000)	($955,000)	($349,000)	($526,000)	($723,000)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling System

Table G-17. Alternative 5 (NRC Recommendations) Estimated Total Regional Economic Activity from Production of Locatable Minerals on Federal Lands (

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	$112,000	$106,000	$137,000	$129,000	$62,600	$59,300	$29,000	$27,500	$79,600
Arizona	49,900	47,400	40,600	38,600	20,500	19,500	12,200	11,600	24,100
California	92,200	87,400	135,000	128,000	72,700	68,900	44,200	41,900	79,600
Colorado	40,000	38,000	57,600	54,700	28,400	27,000	16,300	15,500	33,800
Idaho	55,300	49,800	69,400	62,500	35,300	31,800	20,700	18,600	41,800
Montana	45,900	43,600	61,700	58,600	29,300	27,800	18,200	17,300	37,600
Nevada	1,170,000	1,110,000	1,810,000	1,720,000	830,000	788,000	466,000	443,000	908,000
New Mexico	25,600	24,300	32,000	30,400	12,000	11,400	5,500	5,230	16,600
Oregon	1,910	1,810	1,190	1,130	475	450	855	810	950
Utah	70,300	66,800	49,200	46,700	20,900	19,900	11,100	10,500	25,700
Washington	17,400	16,500	18,900	17,900	11,300	10,700	7,220	6,840	12,600
Wyoming	4,980	4,720	3,330	3,150	1,710	1,620	855	810	2,380
Study-Area Total	$1,690,000	$1,600,000	$3,060,000	$2,990,000	$1,380,000	$1,310,000	$761,000	$721,000	$1,580,000

Estimated Change in Regional Economic Activity from Current Conditions ($000)

State	Value of Production		Total Industry Output		Personal Income				Value
					Total		Employee Compensation		
Level of Impact	Low	High	Low	High	Low	High	Low	High	Low
Alaska	($5,910)	($11,800)	($7,190)	($14,400)	($3,300)	($6,590)	($1,530)	($3,050)	(4,190)
Arizona	0	(2,490)	0	(2,030)	0	(1,030)	0	(610)	0
California	(4,850)	(9,710)	(7,120)	(14,200)	(3,830)	(7,650)	(2,330)	(4,650)	(4,190)
Colorado	0	(2,000)	0	(2,880)	0	(1,420)	0	(815)	0
Idaho	0	(5,530)	0	(6,940)	0	(3,530)	0	(2,070)	0
Montana	0	(2,300)	0	(3,090)	0	(1,470)	0	(910)	0
Nevada	0	(58,500)	0	(90,400)	0	(41,500)	0	(23,300)	0
New Mexico	0	(1,280)	0	(1,600)	0	(600)	0	(275)	0
Oregon	(101)	(201)	(63)	(125)	(25)	(50)	(45)	(90)	(50)
Utah	0	(3,520)	0	(2,460)	0	(1,050)	0	(555)	0
Washington	(917)	(1,840)	(995)	(1,990)	(595)	(1,190)	(380)	(760)	(665)
Wyoming	(262)	(524)	(175)	(350)	(90)	(180)	(45)	(90)	(125)
Study Area Total	($12,000)	($99,700)	($21,500)	($182,000)	($9,730)	($82,000)	($5,360)	($45,200)	($11,100)

Notes: Figures rounded to three significant digits. Employment figures rounded to nearest 10, except figures under 25. Source: IMPLAN Input-Output Modelling Syste